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American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

EDITORS

WILLIAM R. MAXON
R. C. BENEDICT C. V. MORTON
IRA L. WIGGINS

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American Fern Journal

VOL. 36 JANUARY–MARCH, 1946 NO. 1

Xerophytic Ferns in Ecuador

IRA L. WIGGINS

Fences made of wood, or of wire supported between posts, are almost unknown in Ecuador. Fences of rails, pickets, or of boards fastened to upright posts would succumb rapidly to decay and to the ravages of termites. Wire fencing is prohibitively expensive, and even if it were not, the posts upon which the wire is strung would be just as susceptible to fungus and termite damage as those used in constructing an all-wood fence. Add to these deterring factors a scarcity of readily accessible timber in the inter-Andean valley in which many of the larger towns are located, and one quickly understands why earthen walls from one to four feet thick and about seven feet high take the place of fences, as we know them, throughout much of Ecuador.

Small "suckers" or offshoots from mature plants of *Agave sisalana* and *Fourcroya occidentalis*, both fiber plants, are planted along the top of many of the tamped earth walls to reduce erosion during the rainy season. (In the towns and cities a capping of tile or of a hard plaster commonly serves the same purpose and does not eventually split the wall with enlarging roots.) The walls upon which the fiber-producing plants grow form excellent habitats for a number of xerophytic or semi-xerophytic ferns. Practically every earthen wall that has stood through three or more seasons supports from one to a dozen species of ferns. The fern flora on the earthen walls in the larger cities rarely approaches the richness of that on similar walls in the country, for the

[Volume 35, No. 4, of the JOURNAL, pages 97–104, was issued December 18, 1945.]

greater difficulty encountered in securing enough soil to build the wall frequently influences the city dweller to cap his wall with tiles or plaster, and often to apply a coat of the latter to the faces as well. But even on such walls one usually sees an occasional specimen of *Cheilanthes* or a tuft of *Pellaea ternifolia*. Mosses, of course, grow in profusion on such surfaces and are conspicuous during the rainy season, which lasts from late December or early January through May or June.

In urban areas, business buildings and the houses of the well-to-do are usually roofed with tile. Accumulations of dust, decaying leaves, and other debris caught under the edges of the tiles form favorable habitats for plants that are able to sustain themselves during extended periods of low moisture supply. Species of *Cheilanthes, Pellaea, Polypodium,* and *Notholaena* often grow on the roofs, in association with a few succulent or short-lived herbaceous flowering plants, mosses, lichens, and liverworts. The *Polypodium* most frequently seen in such places is *P. thyssanolepis*. Its fronds are one or two decimeters high, bright green on the upper surface, but bearing a few white to rusty lanceolate scales, and with many closely crowded cinnamon-brown scales on the lower surface. The scales are strongly fimbriate along the margins; they are attached slightly above the rounded base and are readily detached. Those of the lower surface are often two or two and one-half millimeters long and have a darker brown spot directly over the point of attachment. Those of the upper surface are rarely over one and one-half millimeters long and the darker central spot is less prominent.

Either this species or a very closely related one grows on the trunks of trees in parks and around buildings where shading is not excessive and where the gardeners remove the masses of epiphytic bromeliads, thus reducing the water-holding capacities of the vegetative covering on

the bark of the trees. I did not find it growing on trees in the dense forests of either the western or eastern cordillera just a few miles away. In the forests, bromeliads, tillandsias, orchids, and other epiphytes are removed only by the death of the individual epiphyte or by the fall of the tree itself, hence there are no miniature "deserts" on the tree trunks in the rain forests.

A second species of *Polypodium* (*P. murorum*), with pinnate fronds one to two decimeters tall, grows abundantly on earthen walls in Carchi Province near the Colombian border, between the villages of San Gabriel and Bolivar. It has narrower segments than those of *P. thyssanolepis,* and lacks the scales on the upper surface of the fronds. The sori are closely crowded and almost confluent. The scales are thicker and narrower than those of *P. thyssanolepis,* and a dull, dark gray that deepens almost to black along the mid-line. At the time I collected it there had been little or no rain for nearly two months and all vegetation in the vicinity showed the effects of the drought. The fronds of the little polypody were fruiting heavily. Those situated on the completely exposed portions of the wall were tightly curled, but those in the shade of the *Agave* plants were still in good condition, some of them beginning to discharge fully ripe spores.

On this same wall—at an altitude of 9,250 feet above sea level—ten or possibly eleven species of ferns were growing! The assemblage included *Polypodium crassifolium, P. lanceolatum, P. murorum, P. angustifolium,* beautiful specimens of *Cheilanthes myriophylla* that had fewer hairs on the segments and narrower scales on the stipes than most specimens from Mexico exhibit, *Pellaea ternifolia,* two spleenworts (*Asplenium praemorsum* and *A. monanthes*), *Notholaena aurea* with both heavily fruiting and younger, sterile fronds, and splendid specimens of *Woodsia crenata.*

On a similar wall in the outskirts of Ibarra (Province of Imbabura, at an altitude of 7,350 feet), *Cheilanthes myriophylla* was abundant, *Notholaena sinuata* was common, *Pellaea ternifolia, P. ovata,* and a third attractive species, *P. sagittata,* mingled with *Notholaena aurea, Polypodium thyssanolepis,* and *P. crassifolium.* Within a few rods were numerous clumps of *Blechnum, Dryopteris, Adiantum, Asplenium, Hymenophyllum,* and other mesophytes—but the latter were on the wall of the canyon facing northeast and seepage from an irrigation flume moistened the cliff.

The presence, almost directly on the equator, of several species of *Cheilanthes, Notholaena,* and *Pellaea* gave me a surprise, for in my mind these genera previously had been associated with the desert and semidesert regions of the southwestern United States and the drier parts of Mexico. And although statements of range had at times read "southward into South America" that continent had seemed distant and rather vague, so such southern extensions of range had not implied desert situations. I had thought that the representatives of such genera in Colombia, Ecuador, and Venezuela were those that had not had to adapt themselves to arid conditions, but had maintained the mesophytic characteristics common among plants living in the "rain-drenched tropics." But xerophytic members of these genera had found suitable habitats in minute corners of the land where three feet of rain fell during the year! Even the species of *Polypodium* that grow on the walls in Ecuador are definitely xerophytic in appearance and in physiological adaptations. Their fronds are thick and leathery. Those mentioned above bear more or less closely arranged scales on the stipes and fronds, and they curl into tight clumps when dried out, apparently unrolling again if an occasional shower replenishes the meager supply of water. The heavy fronds of *P. crassifolium* seem able to retain enough

water at the onset of the dry season to permit the maturation of a high percentage of the spores, even though the vegetative tissue begins to turn yellow and die along the margins of the erect blades. There was no observable evidence that these erect, simple fronds oriented themselves with the edges toward the sun during the course of the day, but they did seem to be uniformly turned with the plane of the blade roughly parallel with the north-south line. A similar uniform orientation of hundreds of fronds was noticeable on dry, rocky hillsides and ridges where rapid drainage and shallow soil approximated the arid conditions of the walls.

The Aspleniums that grow on the earthen walls also have thickish, subcoriaceous leaf-segments, and one of them (*A. praemorsum*) is copiously supplied with a vestiture of shining dark brown hairs that terminate and radiate from beautiful hyaline, irregularly shaped scales. Some of the younger fronds have such a close covering of the shining hairs that they appear at first glance to be set with oily glands. No glands are present. On the older fronds the greater distance between the individual scales dispels the illusion of glistening glands.

The presence of xerophytic ferns in Ecuador should not be considered exceptional, for there are true deserts of considerable extent within the country. These natural deserts are of two kinds—those formed in the "rain shadows" of lofty mountain peaks that intercept the prevailing, moisture-laden winds, and those lying near the coast with a low relief, along which flows the cool Humboldt Current. The latter set of physical conditions precludes appreciable rainfall for months on end, for the air-masses of the land are warmer than those moving inward from the sea and therefore absorb tremendous volumes of water-vapor without permitting any condensation until these air-masses are forced upward by the majestic bulk of the Andes lying a hundred kilometers or more behind

the coast line. Much of the intervening region is desert of a very pronounced type.

In either type of desert one should expect to find a few xerophytic ferns. But the mud-wall and tile-roof habitats do not occur within the confines of either the coastal or the rain-shadow deserts. Rather, they are situated within the great inter-Andean valley that runs almost without interruption from southern Colombia into Peru. At Quito, where the elevation is 9,300 feet above the level of the sea, the average rainfall is approximately 40 inches per year. Of course the countryside as a whole in the vicinity of Quito is by no means desert! Nor do desert conditions prevail generally at Ibarra, where the average annual rainfall is about 26 inches, nor at Loja with about 32 inches per annum. And yet, in all these places and at numerous others not mentioned, man has produced an ecological niche entirely out of keeping with the natural climatic characteristics by turning a small portion of the fertile soil up on edge!

When the earthen fences are constructed the soil is mixed into a stiff mud and thoroughly tamped into vertically set forms. After the packed mud has dried or "set" for a day or two the forms are moved forward and another portion of the wall tamped into place. The soils within the walls are only slightly if at all different chemically from those of the surrounding hillsides and valleys. But physically they are very, very different. The walls are similar, ecologically, to steep, knife-like ridges. The percolation of moisture into them during rains is low and the run-off high. Aeration is correspondingly reduced, and the tamped earth offers poor conditions for deep penetration of roots. Sporelings and seedlings of mesophytic ferns and flowering plants are unable to survive much beyond the cessation of the daily rains. Only those forms that have successfully met and conquered arid

regions of vaster extent seem well fitted to fill this niche in an artificial desert.

To me, this occupation of a narrow, highly specialized habitat by a comparatively small group of ferns illustrates beautifully the ecological principle that given a particular set of conditions, only those organisms *best* fitted to exploit those conditions can successfully compete for the space available. With myriads of individuals of mesophytic flowering plants and ferns growing nearby, often at the very bases of the walls, there is no dearth of migrants from adjacent colonies. Yet these luckless migrants from moister habitats die. Only the xerophytes survive in these deserts of the walls.

I wish to express here my appreciation of aid extended me by Dr. William R. Maxon, who furnished determinations of species previously unknown to me and verified my tentative identification of others.

STANFORD UNIVERSITY.

A New Argentine Variety in Notholaena

C. A. WEATHERBY

In a collection of ferns recently received from Dr. Angel L. Cabrera of the Museo de la Plata is a plant from the Sierra de la Ventana which, though obviously closely related to typical *Notholaena Buchtienii* Rosenst. and like it in general habit, in the scales of the rhizome, and in the type of tomentum, yet differs enough in lesser characters to make it worth distinguishing as:

Notholaena Buchtienii var. **ventanensis** var. nov., a varietate typica differt statura minore (ut videtur), frondibus ad 15 cm. tantum longis, tomento paginae inferioris laminae pallide brunneo, pagina superiore dense persistenterque albido-tomentosa.

ARGENTINA: Partido de Tornquist, Sierra de la Ventana, Estancia Funke, Cerros Grietas, November 14, 1943, *Cabrera* 8101, type, in Herb. Gray. Here should

also be referred the specimen collected by Lorentz in the Sierra de la Ventana, February–April, 1881 and cited under *N. Buchtienii* in my article on Argentine species of Notholaena.[1]

Typical *N. Buchtienii* has the well-developed fronds usually more than 15 cm. tall, the indument of the lower surface rather deep rusty brown and the upper surface

only thinly arachnoid-tomentose when young, soon glabrate. The variety *ventanensis* may very likely have been the basis of Hicken's reports of *N. Fraseri* and *N. hypoleuca* from the Sierra de la Ventana.[2] The Lorentz specimen above cited was distributed as *N. hypoleuca.*

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[1] Lilloa 6: 266. 1941.

[2] Polypodiacearum Argentinarum Catalogus. Rev. de la Plata 15: 255, 256. 1908.

The Sierra de la Ventana is an isolated upland in the southern part of the province of Buenos Aires, some 300 miles from the nearest highland of comparable height to the west and some 400 from the nearest station for *N. Buchtienii* known to me. Various Andine species reappear in it at disjunct stations; in view of the considerable degree of isolation it is not surprising that some of them should show divergences from the parent stock.

The accompanying map[3] gives the range of typical *N. Buchtienii* so far as I know it (dots) and the region in which the variety occurs (cross).

GRAY HERBARIUM

Fashions in Fern Cultivation

RALPH C. BENEDICT

A recent spell of working in the attic, looking over classroom notes, periodicals, and various memoranda—some of them more than 50 years old—has prompted a survey of the present status of ferns as cultivated plants, which shows that the changes within the past 25 years have been considerable. Three main phases in the culture of ferns may be indicated: (1) Greenhouse cultivation of a wide range of tropical species, primarily for scientific purposes; (2) outdoor cultivation of hardy species and varieties; and (3) commercial culture of tropical and subtropical species for sale as house plants.

GREENHOUSE CULTIVATION

Greenhouse culture of ferns developed during the 19th century largely in association with the systematic study of fern species from all over the world. Most extensively carried out in Europe, it received its greatest stimulus from the work and writings of John Smith,

[3] Drawn on part of one of Goode's Base Maps, published by the University of Chicago.

about a hundred years ago, but continued interest was expressed in the publications of the English writers Lowe, Moore, Schneider, Druery, and others. At the turn of the century the catalogue of the English grower, H. B. May, listed as many as 2,000 species and varieties, although this included also species adapted for outdoor culture. The last 50 years of the 19th century represented the heyday of fern cultivation in Europe, both in number of species and in the spread of interest. This centered in England, where climatic conditions of moisture and mildness combined to create favorable environments in unheated greenhouses and out-of-doors.

In the United States the greenhouse cultivation of a wide range of tropical fern species has been chiefly confined to botanic gardens, although a few growers, notably Dreer, for a good many years carried a considerable range of types. For a long time the New York Botanical Garden maintained an extensive collection of tropical species, largely of American origin, assembled in connection with botanical exploration by that institution; a number of large sections of the extensive greenhouses were devoted entirely to ferns, and hundreds of species could be seen. Over a period of years, with changes in administration and changes of emphasis in scientific and public interest, attention has been shifted more to horticultural, floral, and ecological displays. Nowadays, botanic gardens maintain smaller collections, representative of different fern families and genera. The Brooklyn Botanic Garden, general headquarters for the American Fern Society, has probably as good a collection as any place in the country.

OUTDOOR CULTIVATION

One of the most widespread uses of ferns is as adjuncts of shady corners in outdoor gardens. Usually considered

merely as "ferns," without identification, the housewife of farmhouse or village may have a prized group of Maidenhair—which seems to be the most widely known of all our outdoor species. The remaining species are usually osmundas, Lady-ferns, Ostrich Ferns, or one or more of the Wood-ferns. I suppose the Fern Society has had its origin and growth chiefly from a combination of two interests—the fern gardener, who developed an interest in learning the names of his ferns, and the systematically minded nature lovers and botanists, who observed fern species in the wild. Unlike the lessening of interest which has befallen the cultivation of tropical fern species, hardy ferns have attracted increasing attention in this country. Over a period of more than 50 years the pages of the Fern Journal and the Fern Bulletin testify to the continuity and growth of this interest. In the literature, Robinson's "Ferns in Their Homes and Ours" (1878) has been followed by a long series of books devoted to the identification and culture of native ferns, including those of Underwood, Clute, Parsons, Woolson, Slosson, Waters, and, most recently, Small and Wherry.

AS HOUSE PLANTS

Ferns as house plants have had their chief commercial development in the United States, with a climax in use and sale during the first 20 years of this century; they felt the influence of our tendency toward mass production and distribution. Particularly, attention was centered on the Boston Fern (*Nephrolepis exaltata* var. *bostoniensis*) and its very numerous forms. Sometime around the turn of the century, this fern displaced the older "tree that grew in Brooklyn"—the rubber plant (*Ficus elastica*)—until it came to be the most widely used of all house plants. Partly, this was due to its adaptability to culture in the average American home,

and partly to the fact that in its extensive variation it received widespread advertising and not infrequently offered opportunity for wealth to the grower who might bring out and exploit some new variety successfully. It has been reported that the small runner plants of the earliest *Piersoni* variety were worth almost their weight in gold.

About 1920, the fashion in house plants began to change. The mine of exploitable new types from the Boston Fern had been worked out; and although commercial cultivation of these plants continued extensively for some time, it concentrated on the relatively few varieties that had proved best adapted for mass production and for use in the limited quarters of city dwellers. Here plants are comparatively short-lived, and these Boston Fern types, even with their relatively good cultural qualities, cannot compete with *Sansieveria*, for which the preferred common names seem to be "snake plant" or "mother-in-law's tongue." Also, the fad of small cactus gardens displaced the older "fern-dish" florist package. Botanic Gardens had to place wire fences in front of their collections of small cacti in the nineteen-thirties.

Mention of fern-dishes was made in the last paragraph. This phase of commercial fern use paralleled that of the Boston Fern, and still persists in a small way. The species used are known in the commercial trade as "table-ferns," and comprise ferns of small size, raised from spores, and originating chiefly in subtropical regions. In the retail florists' trade, they represent a sort of green "bouquet," grown in a 5- to 7-inch flat pot, and designed to serve as a centerpiece for the dinner table. Cut glass, pottery, and metal receptables of appropriate size and shape were produced, and the plantings often included a small palm at the center. Such

a fern-dish was only temporarily decorative, however, either because the plants soon suffered from the cultural conditions or because presently they began to exceed the bounds of their pot space and to grow beyond the limits of symmetry and decorative value.

These notes on changing fashions in fern culture were stimulated chiefly by copies of florists' trade magazines of some 25 years back, when growers' advertisements were abundant, both for Boston Fern types and for table-fern species. As a basis for definite evidence, we may take the "Florists' Exchange." Whereas the issues of 1915 to 1922 contained page after page of offerings of a dozen different *Nephrolepis* types, a recent issue (June, 1945) does not mention the Boston Fern series at all. Three advertisements comprise the entire list of fern offerings, which are: plants of *Cibotium*, a pale, yellow-green tree-fern; "cut, fancy ferns" (packages of the evergreen leaves of our wild *Dryopteris intermedia* which florists use with cut flowers); "fern-dish species" and packets of fern spores, offered by Anderson, of Short Hills, New Jersey. Interestingly enough, Anderson's advertisements seem to have had a continuity of at least 25 years.

By way of concluding comment, it may be remarked that even though ferns are no longer produced and distributed in quantity, many kinds, given reasonable care in the home, are still excellent house plants and that over the country many homes still contain thrifty plants of a number of attractive species. A few of these, like the Holly-fern (*Cyrtomium*), can be acclimated outdoors in the milder parts of the country. Others, especially in the table-fern group, show a diversity of form, size, and even color, which makes them very interesting to raise.

BROOKLYN BOTANIC GARDEN AND BROOKLYN COLLEGE.

Ferns in Birds' Nests

ALEXANDER F. SKUTCH

Fern study is one of those happy pursuits which we follow for their purely intellectual or aesthetic stimulus, without feeling the obligation to consider material gains or losses. Aside from those which enter into the florist's trade, few ferns are of commercial importance, and none on a scale which equals that of hundreds of flowering plants, and even of some fungi and seaweeds. Still fewer are the ferns inimical to the interests of man; only one with which I am personally familiar can be classed as a noxious weed—the Bracken. To other animals as well as to man, ferns are of slight utilitarian importance. They appear rarely to be touched by herbivorous animals, which will eat almost any kind of monocotyledonous or even dicotyledonous foliage in preference to fern fronds. They seem to be relatively free even from the attacks of leaf-eating insects. The Bracken, for example, appears to owe much of its success in the world to its amazing freedom from animal enemies, whether vertebrate or invertebrate.

Among the few higher animals which find a use for ferns are birds. Like ourselves, they probably use them for adornment more often than for utilitarian ends. According to Sharpe, Newton's Bower-bird (*Prionodura Newtoniana*) of Queensland, Australia, collects ferns, along with tufts of moss and clusters of green fruit, for the ornamentation of its astonishing "bower," which may be six or even eight feet in height, and is the playhouse of numerous individuals of both sexes. The female Newton's Bower-bird is said to decorate the outside of her cup-shaped nest with the same mosses and ferns that are placed in the bowers. In Central America, the Scarlet-rumped Black Tanagers (*Ramphocelus passerinii pas-*

serinii and also *R. passerinii costaricensis*) habitually decorate the exterior of their cup-shaped nest with a spray or two of green fern, preferring for this purpose an epiphytic Polypody with cordlike, creeping rhizomes, such as *Polypodium ciliatum* Willd.

The Orange-billed Sparrow of tropical America (*Arremon aurantiirostris*) often uses many pieces of green fern frond in the construction of its oven-shaped nest, built on a steep slope or a little mound of earth beneath heavy forest. The large pieces torn from the living fronds may form part of the roof, or a platform or pavement in front of the wide round doorway. Once I found parts of fronds of three species in one nest; but at another nest *Selaginella* had been substituted for the ferns. Since the nest is often built among ferns, these bits of frond make it less conspicuous.

A nest of a small Costa Rican honeycreeper, the Scarlet-thighed Dacnis (*Dacnis venusta*), a slight structure not much broader or deeper than the crystal of a man's watch, was entirely covered on the bottom with green pieces of *Nephrolepis pendula*, some of them four inches long—the length of the bird!—and one and one-half inches wide, containing many pinnae. With this covering, the nest blended so well with the tangle of the parasitic vine (*Struthanthus*) amid which it was placed in a tree-top that it cost me several hours to find it, in spite of the loud, betraying cries of the noisy nestlings. In these last two instances the ferns employed in the bird's nest served the utilitarian purpose of making it harder to find.

As an integral part of the nest, ferns are used by birds far less often than mosses and hepatics. The brown ramentum-scales of tree-ferns and other species with giant fronds are perhaps more often used as an essential building material than any other parts of ferns.

Hummingbirds not infrequently seek this light and soft material for their delicate little nests. I once found a nest of the lovely purple-and-green Colombian Wood Nymph (*Thalurania colombica*) composed almost wholly of brown fern ramentum, bound together with cobweb. A nest of the Costa Rican Mountain Gem (*Oreopyra castaneoventris*) contained a liberal admixture of ramentum, along with fine leafy hepatics. Among bigger birds, the beautiful ovenbird *Pseudocolaptes Lawrencei* of the Costa Rican highlands carries many billfuls of fern ramentum into its nest in an old woodpecker hole or other cavity in a trunk.

While collecting ferns along a rivulet which flowed through a narrow chasm between rocky walls overgrown with ferns and aroids, in the Costa Rican mountains, I found my first nest of the Green Hermit (*Phaethornis Guyi*), a relatively big hummingbird with a long, strongly curved bill and a long, white-tipped tail. The downy cup was fastened beneath one of the broad strips into which the great leaf of a *Heliconia* had been torn; with liberal quantities of cobweb passed over the back of the strip it was firmly attached to the glossy leaf, and additional cobweb bound together the walls. Beneath the green roof two homely, naked nestlings slumbered in their swinging cradle. Cobweb so thickly covered over the surface of the nest that I could not without injuring the fabric determine of what soft material it was made. But three weeks later I returned and, finding that the young hummingbirds had flown, pulled apart the empty nest and learned that it was composed principally of the long, slender, brown ramentum-scales of a tree-fern, mixed with which were a number of fine fibrous rootlets, probably also of ferns. The tiny brown Dusky Hermit (*Phaethornis Adolphi*) also at times incorporates a liberal portion of ramentum-scales in its downy nest,

attached beneath the pointed tip of a segment of a palm frond.

Thus ferns may enter into birds' nests as an essential structural constituent, as ornament, or as camouflage.

SAN ISIDRO DEL GENERAL, COSTA RICA.

Shorter Notes

LYCOPODIUM TRISTACHYUM IN INDIANA.—Although the Ground-cedar, *Lycopodium tristachyum* Pursh, was not attributed to Indiana by C. C. Deam,[1] there are several specimens in the herbarium of the University of Illinois collected by E. J. Hill, and later by Agnes Chase, in Lake County in northwestern Indiana that appear to belong to this species. In 1930 this lycopod was attributed to Indiana by D. C. Peattie[2] with the statement, "On wooded dunes, Dune Park, Miller."

As early as 1901, E. J. Hill had written an article[3] ascribing *Lycopodium tristachyum* to Indiana, with citations of specimens. "From all I recall about the Lycopodiums that I had identified as *L. complanatum*, but did not take specimens for preservation, I feel quite safe in stating from the impression its habit has left in memory that *L. tristachyum* is the more common in places where I have met with the two species in the upper lake region. Those growing at Miller, Ind., do not seem to fruit very freely, the shoots being commonly found barren."

To substantiate further the record of the occurrence of *Lycopodium tristachyum* in Indiana the following specimens in the herbarium of the University of Illinois are cited: Sandy pine woods, Miller, Lake Co., July 8, 1878, *E. J. Hill* 271; also May 24, 1879, *E. J. Hill* 41, and October 1, 1881, *E. J. Hill* 183. Shaded side of sand hill, Miller, August 2, 1897, *Agnes Chase*. Wooded sand hill,

[1] Flora of Indiana 1022. 1940.
[2] Flora of Indiana Dunes 36. 1930.
[3] Torreya 1: 76–77. 1901.

Dune Park, August 4, 1902, *Agnes Chase* 1920. In their apparently deep-set rhizomes, numerous, narrow, crowded branches, and scarcely reduced under-leaves, these plants are clearly distinguished from *L. flabelliforme* (Fern.) Blanch., which also occurs in Indiana. All the specimens except *Hill* 183 are sterile.—GEORGE NEVILLE JONES, *University of Illinois.*

NOTHOLAENA NEGLECTA IN TEXAS.—In a small parcel of ferns lately sent to the Gray Herbarium by Mr. H. D. Ripley and the writer, one specimen is of special interest as representing the first record of *Notholaena neglecta* Maxon from Texas. The plants were found in crevices of dry limestone rocks at the edge of a ravine 10 miles west of Longfellow, Brewster County, at 3,700 feet altitude (*Ripley & Barneby* 4103), and were in full vigor in the second week of January. This species is known elsewhere in the United States only from southern Arizona, whence it extends into the mountains of northern Mexico. I am indebted to Mr. C. A. Weatherby for confirming the identification of the specimens and for pointing out the extension of range.—R. C. BARNEBY.

ON THE OCCURRENCE OF ASPLENIUM ADIANTUM-NIGRUM IN FLORIDA.—Since writing recently the discussion of the anomalous occurrence of *Asplenium Adiantum-nigrum* in Florida,[1] based on Correll's report, I have had the opportunity, thanks to Dr. Svenson, of examining the sheet preserved in the Brooklyn Botanic Garden upon which the report was based. The sheet in question bears a printed label reading "Florida Filices. *Asplenium myriophyllum* Pres. Limestone rocks, Ocala, Fla., Dec. 1879. Collected by Mary C. Reynolds, . . ." and three specimens. One is a small plant, consistent with the label, of what is now known as *A. verecundum.* Two

[1] Amer. Fern Journ. 35: 120. 1945.

detached fronds of *A. Adiantum-nigrum* are clearly extraneous and surely have been accidentally added to the sheet subsequent to the original distribution by Mary Reynolds. *Asplenium Adiantum-nigrum* is, then, known only from Colorado, Utah, and Arizona, since its alleged occurrence in Florida was based on a mixture. Thus, insofar as North America is concerned, the species falls into the familiar holarctic relict pattern. Its extralimital distribution, and the distribution of certain other ferns discussed, remains enigmatic.—J. EWAN, *Smithsonian Institution.*

A FURTHER NOTE ON EQUISETUM LAEVIGATUM F. PROLIFERUM.—In a recent note[1] I called attention to the widespread distribution of *Equisetum laevigatum* f. *proliferum* Haberer ex House. This form, distinguished by the branching at the apex of the stem, has recently been studied in the field along the Illinois Central Railroad south of Champaign, Illinois. It was noted that the tip of the main stem of all plants which would be classified as f. *proliferum* was injured in some manner. In one place, it was noted also that in order to reach a switch standard a man would have to walk through an abundant growth of *Equisetum*, and around this standard I estimated that over 90 per cent of the plants were of f. *proliferum*. From the above observations it would seem that this form is caused by mechanical injury to the stems of typical *E. laevigatum.*—WILLIAM F. RAPP, JR., *University of Illinois.*

Recent Fern Literature

A delayed European publication, recently received, contains an interesting paper by Dr. M. C. de Rezende-Pinto, of the Universidade de Coimbra (Portugal), en-

[1] Amer. Fern Journ. 35: 56. 1945.

titled "Culcita macrocarpa Pr., Contribuïção para o seu estudo monográfico."[1] The small genus *Culcita*, of 9 or 10 species, tree-ferns of the family Dicksoniaceae, is exclusively tropical except for *C. macrocarpa*, which was formerly thought to be confined to Teneriffe, Madeira, and several islands in the Azores. It has, however, been found at Algeciras and Gibraltar in Spain and is now reported for the first time from Portugal. The locality, Valongo, at about 2,000 meters elevation in the Serra dos Póvoas, is much the farthest north. The localities in Spain and Portugal are presumed to represent relict colonies indicating a more general distribution in past times.

The present paper is quite comprehensive and is illustrated with many drawings and photographs. In the anatomical section one of the points of interest is that the vascular system of the stem is a simple amphiphloeic siphonostele, rather than a complicated dictyostele, as is postulated for the family Dicksoniaceae by Christensen. Study of the phyllotaxy shows a leaf divergence of 144°. In mature plants two leaves are borne each year, these persisting about two years. The cytological section of the paper gives details as to meiosis. The chromosome number is high, about 65. As in many ferns, the nucleus in the spores is borne close to one of the angles. This is caused, as Dr. Rezende-Pinto shows perhaps for the first time, by the development in the center of the spore of a large fat-globule. Details are given also as to the germination of the spores, including experiments conducted in different illuminations. Normal dorsiventral prothallia are formed only under good light; only threadlike prothallia are formed under deficient illumination.—C.V.M.

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[1] Bol. Soc. Broteriana **17**, Ser. 2A: 93–146. *pl. 1–3, map, 40 text figs.* 1943.

In the same publication appears an enumeration of the pteridophytes of the Azores,[1] with a tabular presentation of their geographic distribution. As is well known, islands if long isolated, are likely to develop endemic forms. However, the Azores have no endemic species or varieties of Pteridophyta, and, as a matter of fact, this group is poorly represented, considering the mild, subtropical climate. There are only 39 species, excluding introductions. A close relationship with the flora of the eastern coast of North America is apparent in the presence of such species (sometimes in varietal forms) as: *Ophioglossum vulgatum, Botrychium Lunaria, Osmunda regalis, Trichomanes radicans, Hymenophyllum tunbridgense, Cystopteris fragilis, Dryopteris dentata, D. Filix-mas, D. spinulosa, Athyrium Filix-femina, Phyllitis Scolopendrium, Asplenium monanthes, A. Trichomanes, Anogamma leptophylla, Adiantum Capillus-veneris, Pteridium aquilinum, Polypodium vulgare, Elaphoglossum hirtum, Lycopodium cernuum, L. complanatum,* and *L. Selago.* The presence of *Elaphoglossum hirtum* in an apparently identical form in the Azores and Jamaica is significant, as showing a former closer connection between these distant islands. Almost all the species of the Azores occur also in the larger island of Madeira, which has besides a number of additional ones, including three endemic species of *Polystichum.*—C.V.M.

In a brief note in Darwiniana (**6**: 608–610), supplementary to her recent treatment of the Ophioglossaceae of Argentina, Juana S. de Lichtenstein records *Botrychium cicutarium* (Sav.) Sw. from northern Uruguay—the first collection for that country and an extension of range from southern Brazil.—C. A. WEATHERBY.

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[1] R. Telles Palhinha. "Pteridófitos do Arquipélago dos Açores." Bol. Soc. Broteriana **17**, Ser. 2A: 215–243. 1943.

American Fern Society

Report of the President for 1945

The year's end finds the American Fern Society in excellent condition. Membership has increased, bills are paid, the Treasurer reports increased assets, and the JOURNAL is growing in influence and authority.

I am certain that the members of the Society have three hard-working and most efficient executives in our Editor, Secretary, and Treasurer. Furthermore, they work together in such close harmony and with such zest that it is a joy to be associated with them. You will be interested to know that the work of the Society has been conducted in strict conformity to the Constitution. The Council by letter, by conference, and by directives duly authenticated, has kept the business of the Society in good order.

Travel and hotel restrictions have made meetings out of bounds, and as these conditions continue for the present we are more dependent on our JOURNAL and on letter-writing. I am very happy to announce that Mr. Ewan, our genial Vice-President, has consented to serve as convenor and as chairman of a meeting[1] of Fern Society members and friends who will be in attendance at the St. Louis meeting of the American Association for the Advancement of Science in March.

I sincerely hope that this gathering will bring together a large number of fernists, who will send in at once the titles of their papers to Mr. Ewan at the Smithsonian.

Elsewhere in this issue are some suggestions to amateurs, of which group I am one, for the enlarging of our interests and for the development of our participation in the life of the Society. The Society needs more amateurs in its membership and these members

[1] Parlor D, Lennox Hotel, St. Louis, March 30, at 9:00 A. M.

need the constant and persuasive influence of the Society and of its JOURNAL, that this interest may not die back on itself.

There is one feature I wish we might take time and thought to develop, and that is mutual acquaintance. As I have travelled about and time has been available, I have sought out Fern Society members for a bit of visit. We are a peculiar people! An amateur fernist is always a person of rare interest and always worth knowing. Some of the richest hours of my life have been spent with persons here and there across the country who are interested in ferns. I have learned something from every one. If you are interested in learning who the members are and where they live, write me and I will gladly send you a copy of the mimeographed membership list I had run off for my own use.

May I request that our present members continue the good work of enlisting new members. Most of us have friends who will find membership in the Society a worthwhile venture. The Secretary will gladly send you, on request, a folder and an application blank which you may care to pass on to an interested friend.

There are several projects maturing which will be presented in the JOURNAL for your consideration later in addition to those mentioned elsewhere in this issue.

FREDERICK L. FAGLEY, *President*

Report of the Secretary for 1945

During the year no meetings of the Society have been held, but the day-to-day, uneventful functional activities have been steadily carried on. In the early part of the year a letter explaining the aims of the Society and the privileges of membership, together with an invitation to become one of us, was sent to each individual on the considerable list of names contributed by our members, and favorable replies, accepting membership, came back from

about 10 per cent of those listed. This was one factor in the increase of 40 new members during the year. During the same time losses through resignations, deaths, and nonpayment of dues amounted to 20, leaving a net gain of 20 for the year. The total membership on December 31 was 381.

Of the five members lost by death, Charles Ormun Rhodes and Miss Nellie Mirick were almost charter members, both having joined in 1896. Lewis S. Hopkins joined in 1905, and Vol. 1, No. 2 of the JOURNAL announced the election of Miss Mirick as Vice-President and Mr. Hopkins as Secretary of the Society. Both were re-elected to these offices for several years, and in 1912 Dean Hopkins took on also the duties of the Curator of the Society's herbarium—a service which he contributed for many years. Death also claimed Dr. Frederick K. Butters, a member since 1917, and Mrs. Theodore M. Knappen, 1925. All these faithful members will be greatly missed.

The growing list of Life Members now numbers 12. This increase indicates not only that these members expect no lessening of their own interest in ferns but also a faith in the continuing growth and services of the Society that is a sincere compliment.

There have been some inquiries from members about an up-to-date membership list. Since the issuance of the last one in 1938 well over 500 additions and corrections have been made. How useful is the list to members in exchanging specimens or information? Perhaps a fuller expression of the desires of the members should determine whether or not funds, if available, ought to be expended on such additional printing costs.

Through the generosity of the American Association for the Advancement of Science the Society received a half-page display, stating the purpose of the Society, in

the August number of *Scientific Monthly*. This courtesy was extended to a number of the organizations affiliated with the American Association, and such an opportunity to be brought to the attention of a larger public was greatly appreciated.

With the change from war efforts to more normal expressions of human activities it is to be expected that the Society can once again make plans for meetings and field excursions. This should result in inspiration for renewed activity in fern study that will find the answers to some old questions—and bring to light many new ones!

Respectfully submitted,

ELSIE G. WHITNEY, *Secretary*

Report of the Treasurer for 1945

It is a pleasure to be able to report that the Society is in much better financial condition than it was a year ago. Our membership has held its own, and furthermore, two of our members, Mrs. Whitney and Mr. Slater, have taken out life memberships, which means an income for the year of $50. Also we have sold $346.19 worth of back numbers, mostly for the purpose of completing library sets. The profit from these sales is $79, which amount has been transferred to the reserve fund. The sale of back numbers during 1944 was $366.33.

We have had the good fortune to receive a bequest of $1,000 from the estate of Miss Amy E. Lillibridge of Providence, Rhode Island, in addition to books and an herbarium. An account of Miss Lillibridge will be prepared for a succeeding issue of the JOURNAL. We also received from the estate of our late member, Miss Nellie Mirick, books for the Society Library valued at $100.

The treasurer wishes to thank all members of the Society for their cooperation during the past year. The financial report follows:

Receipts	*Amount*	*Sub-total*	*Total*
Cash on hand Jan. 1, 1945			$ 310.04
Cash withdrawal from Bissell Herbarium Fund			10.30
1942 Membership Arrears	$ 1.50	$ 1.50	
1943 Membership Arrears	9.00	9.00	
1944 Membership Arrears	40.50	40.50	
1945 Membership Renewals	370.00		
1945 New Members	48.00	418.00	
1946 Membership Renewals	20.00		
1946 New Members	9.00	29.00	
1947 Membership Renewals	1.50	1.50	
1944 Subscription Arrears	1.25	1.25	
1945 Subscription Renewals	52.02		
1945 New Subscribers	10.00	62.02	
1946 Subscription Renewals	60.73		
1946 New Subscribers	8.85	69.58	
Life Membership	50.00	50.00	
Sale of back numbers A.F.J.	346.19		
Sale of A.F.J. Cumulative Index	6.00	352.19	
Sale of "Vars. and Forms of Ferns of E. No. Am."	.35	.35	
Sale of Fern Bulletins	5.50	5.50	
Sale of Hart's-tongue Fern	1.10	1.10	
Sale of R.C.B. Misc. Reprints	.70	.70	
Gifts (cash)			
Not restricted	1,000.00	1,000.00	
1945 Membership	1.50	1.50	
(books)			
A.F.J. back numbers	18.62	18.62	
A.F.S. Library	150.00	150.00	
1945 Advertising	4.00	4.00	
Reprints	19.37	19.37	
Overage (excess payments) Sales A.F.J.	2.93	2.93	$2,238.61
			$2,558.95
Deduction a/c Life Membership[a]		50.00	
Deduction a/c Profit on Sales A.F.J.[b]		79.00	
Deduction a/c Sales Discount A.F.J.[c]		27.92	
Deduction a/c Sale Hart's-tongue Fern[d]		.35	
Deduction a/c Gift (cash) not restricted[e]		1,000.00	
Deduction—1945 Membership[f]		1.50	
Deduction a/c Gift (books) A.F.J. back numbers[g]		18.62	
Deduction a/c Gift (books) A.F.S. Library[h]		150.00	
Deduction a/c Agency Commission (subscribers)[i]		8.97	

Deduction a/c Bank Charges (1945 Memb.)[j]	.20	
Deduction a/c Bank Charges (1945 Subscr.)[k]	.27	$1,336.83
		$1,222.12

[a] Transferred to Spec. Acct. No. 2.
[b] Transferred to Reserve Fund.
[c] Deducted at source of sale.
[d] Transferred to W. H. Dole.
[e] Transferred to Reserve Fund.
[f] Held for collection by Brooklyn Trust Co.
[g] Transferred to Inventory A.F.J.
[h] Transferred to A.F.S. Library Acct. (books).
[i] Deducted at source of subscription.
[j] Deducted by bank at time of deposit.
[k] Deducted by bank at time of deposit.

Disbursements

Science Press			
A.F.J. Vol. 34, no. 4	$ 147.42		
A.F.J. Vol. 35, no. 1	163.92		
A.F.J. Vol. 35, no. 2	145.45		
A.F.J. Vol. 35, no. 3	143.39	$ 600.18	
2500 printed clasp envelopes	23.13	23.13	
Reprints	19.37	19.37	
Bank Charges (service and activity)	12.14	12.14	
Refunds a/c Overage			
Mr. Cecil Billington	2.63		
Brooklyn Botanic Garden	.30	2.93	
Postage			
Sales A.F.J.	8.75	8.75	
Expense			
Treasurer	28.15	28.15	
Secretary	20.34	20.34	
Editor	9.36	9.36	
Librarian	10.00	10.00	
Curator	10.30	10.30	$ 744.65
Cash on hand Jan. 1, 1946			$ 477.47

STATEMENT, DECEMBER 31, 1945

Assets			*Liabilities*	
Cash on hand	$ 477.47		Capital Acct.	$2427.66
In Spec. Acct.			Suspense Cr.	
No. 1	508.88		1946 Memb.	29.00
In Spec. Acct.			1947 Memb.	1.50
No. 2	132.81		1946 Subscr.	70.51
In Reserve Fund	1315.01	$2434.17	Distrib. Vol. 35,	
Notes Receivable		1.00	No. 4	100.00
Inventory A.F.J.		488.10	Bissell Herb.	
A.F.S. Library			Fund	508.88

(books)	340.70	Life Memb. Fund	132.81
Suspense Dr. 1946 Agency Com.	6.39		
	$3270.36		$3270.36

Respectfully submitted,

HENRY K. SVENSON, *Treasurer*

Report of the Auditing Committee

The undersigned have checked all the receipts and expenditures of the American Fern Society for 1945 and find the Treasurer's statement correct.

We find the finances of the Society in a healthy condition and desire to commend Dr. Svenson and his staff for their very careful work.

ARTHUR H. GRAVES
WALTER S. ALLEN
Auditing Committee

Report of the Judge of Elections

The results of the recent balloting for officers of the American Fern Society for 1946 are as follows:

For President	
Dr. Frederick L. Fagley	104
J. M. Shaver	1
R. M. Tryon, Jr.	1
Herbert Dole	1
For Vice-President	
Joseph Ewan	107
Mrs. Frank C. Smith, Jr.	1
For Secretary	
Mrs. Elsie G. Whitney	106
R. M. Tryon, Jr.	1
For Treasurer	
Henry K. Svenson	106
T. T. Earle	1

I therefore declare the following candidates elected to the several offices: President, Dr. Frederick L. Fagley; Vice-President, Mr. Joseph Ewan; Secretary, Mrs. Elsie G. Whitney; Treasurer, Dr. Henry K. Svenson.

HAROLD G. RUGG, *Judge of Elections*

A WORD TO AMATEUR MEMBERS.—We are all proud of our Journal and take much satisfaction in the type of scholarly articles it contains, and I know I voice the unanimous desire of our amateurs that the high standard be not lowered "one jot or one tittle." But I do feel that we should give more attention to the suggestion made by Mr. Weatherby some time ago that the pages might well include more material of non-professional nature. I believe those of us who are not professional botanists might do some things that would add to our enjoyment as amateur fernists and at the same time perhaps furnish some useful information for our learned brethren. With this in mind, I am making the following suggestions:

(1) That we make a careful study of a selected area, to determine the kinds of ferns growing therein. This area might be a county or a town (township in the West) or even a certain farm or restricted section.

Some years ago Dr. C. E. Waters made such a study of the Lake Sunapee, New Hampshire, region and located one of the very few known stations in eastern North America of *Dryopteris fragrans*. When several years later I read of this find I spent some pleasant hours hunting for this station and finally found it, but all that was left was a little bunch of dried fronds. In this search I found ferns that I did not know grew in my neighborhood.

One of the older fern books in its "Introduction" states that near the town of Pittsford, Vermont, "in a certain triangular section with a blasted pine at one corner," there are more different kinds of ferns than recorded for any similar section. I have hunted for that section and never found it, but in the hunting I did find a luxuriant plantation of Walking Fern and a beautiful little park between two mountains where grew in great

perfection the Braun Holly-fern. In fact there were 60 or more of these beautiful plants, larger than any I have ever seen.

In my travels I have discovered sections where ferns grew in notable abundance and variety. I have found such spots near Massena, New York, in southern New Hampshire, near Boulder, Colorado, back of Seattle, Washington, on the shoulder of Mt. Ascutney, Vermont, and in the hills beyond Phoenix, Arizona, but I have no exact record of place nor inventory of varieties. I wish I had kept a record. Would it not be interesting to have occasionally in the JOURNAL brief statements from members giving description of natural fern gardens, with lists of the kinds to be found there?

(2) Some of us have a desire to see certain ferns growing in their natural habitat. For example, I want greatly to see Goldie's Fern growing wild. Now and then in driving through the country I have seen it growing beautifully beside a village home. Upon inquiring of the owner as to where it was found I am told, "it was here when we bought the place" or "the boys found it in the woods"; but what woods, or whether there are others, no one knows. Search as I may, I cannot find it!

The Massachusetts Fern long eluded me until Dr. Allen of Holyoke and his brother (our faithful Auditor) took me one day across a little lake near their New Hampshire summer home to a sunny swamp where it was growing in abundance—now I know the sort of place in which it is at home. I would go a long distance to see certain ferns growing naturally in the wild state. Can not members help in compiling such information? My thought is, that if you know of unusual stations you write what you have found, how you found it, something of the situation as to soil, surroundings, etc.—but that for fear

of "raiders" the exact location be not published. Then, for members who desire to see the specific fern growing naturally in the wild, you can furnish directions when you are satisfied that there is no danger in revealing the facts. Would it not also be helpful and a safe procedure to place in the hands of our Secretary or Librarian this information for the benefit of future generations?

(3) Some of our members are amateur photographers. Why not a collection of really fine photographs of ferns in their natural location? This last summer I was privileged to see a collection of photographs taken by Dr. Miles Krumbine of Cleveland, Ohio, on his New Hampshire plantation. For one of these he waited two hours to get just the right light, and what a beauty! We all recall the pictures of ferns in *The National Geographic Magazine* for May, 1925. I am told by dealers in old magazines that this special issue is one of the most sought after. If you are interested, why not ask our librarian, who keeps so good a collection of herbarium sheets, also to be custodian of pictures? And might we not ask our editor to give us a page now and then of what he considers really worthwhile photographs? There might even be a new issue of the "*Geographic*" where the "cream of the crop" would find a worthy place. At any rate, garden magazines and similar publications are always in the market for exceptional photographs.

We understand that today with the abundance of nature study magazines and books our Society, which in its earliest days was a forerunner of these, does not now have responsibility as a missionary in this field; but many of our members are amateurs and to them the suggestions made herewith for "the good of the order" may be worth consideration. At any rate if you have other suggestions for increasing the interest of amateurs, send your word to the Editor.—FREDERICK L. FAGLEY.

NEW MEMBERS

Miss Gladys Clarke, 1344 Franklin Place N., Milwaukee 2, Wisconsin.

Miss Annie M. Dunlap, 517 Main St., Phoenixville, Pa.

Dr. F. R. Fosberg, R. D. 1, Holmes Run Road, Falls Church, Va.

Miss Mary E. Humphreys, Mary Baldwin College, Staunton, Va.

Mr. Robt. Stuart MacKerricher, 3409 Fruitvale Ave., Oakland, California.

Miss Birdie Padavich, North Bend, Washington.

Mrs. Earl R. Scheafer, 1516 Houstonia Ave., Royal Oak, Mich.

Mrs. Marion L. P. Smith, The Gilbert Institute, Paget, Bermuda.

Mrs. G. W. Steward, Route 1, Box 205, Fowler, California.

Mr. Charles Currier Stockman 2d, 153 High St., Newburyport, Mass.

Miss Mary Sherburne Warren, North Pomfret, Vermont.

Mrs. Nola Yeamans, General Delivery, Chosen, Florida.

CHANGES OF ADDRESS

Mrs. David C. Boyce, Rosalind Gardens, Dobbs Ferry, New York.

Lt. Wesley O. Griesel, 4103 Sunset Drive, Los Angeles 27, California.

Mr. Ralph M. Kriebel, Agric. Expt. Station, Purdue University, Lafayette, Ind.

Dr. Robt. H. McCauley, Port Wentworth, Georgia.

Dr. R. Milton Tryon, Jr., 500 S. E. Harvard St., Minneapolis, Minn.

Miss Mary F. Wright, 231 Winona St., Philadelphia 44, Pa.

I have for sale the following books, in good second-hand condition and perfect as to contents.

Waters, C. E. Ferns. New York, Henry Holt & Co., 1908. 4to, 362 pp., numerous illustrations $12.00

Woolson, G. A. Ferns and how to grow them. New York, Doubleday, Page & Co., 1905. Vol. 2 of the Garden Library. 12mo, 156 pp., 32 plates $1.50

C. A. WEATHERBY,
27 Raymond St., Cambridge 40, Mass.

Mr. George R. Proctor wishes to buy a set of "The Fern Bulletin" or any separate numbers of the same. Address: 140 West Main St., Newark, Delaware.

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EDITORS

WILLIAM R. MAXON

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American Fern Journal

VOL. 36 APRIL–JUNE, 1946 NO. 2

A Mindoro Fern Adventure

E. D. MERRILL

The Philippine Archipelago lies wholly within the humid tropics, extending 1,100 miles north and south and 600 miles east and west. The topography is essentially mountainous; the highest peaks on Luzon and Mindanao are about 10,000 feet high. The land area is not great, being about that of the New England States and New York combined, but nearly one-third of it is covered with primary forests. The conditions are most favorable for the growth of ferns, and that the fern flora was an exceedingly rich one was apparent about a century ago when the collection assembled by Hugh Cuming in 1836–40 became available to European botanists. In 1841 John Smith[1] in his preliminary study of the material, listed 297 species of true ferns from this one collection, of which 100 were presumed to be new; a few of these were actually from the Malay Peninsula, however. It is rather difficult to estimate closely the total number of species of ferns and fern allies that actually occur in the Philippines, because of the very complicated synonymy, but not far from 1,000 species have been recorded; this number is probably too high, however. A conservative estimate would be about 925 valid species of ferns and fern allies for the entire Archipelago.

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[1] Smith, J. Enumeratio Filicum Philippinarum; or a systematic arrangement of the ferns collected by H. Cuming, Esq., F. L. S., in the Philippine Islands and the Peninsula of Malacca, between the years 1836 and 1840. Journ. Bot. Hook. 3: 392–422. 1841.

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It fell to my lot to exploit extensively the Philippine flora over the period of nearly 22 years that I resided in Manila. I claim no special knowledge of ferns, for although my numerous exploring trips took me to all parts of the archipelago and ferns were always grist to my mill, the actual study of the assembled collections was done by others, notably by Dr. H. Christ and Dr. E. B. Copeland. As the collections increased in size I made many current identifications by comparison with named specimens, and naturally did absorb a great deal of knowledge of Philippine ferns.

This paper is not offered as one in which Philippine fern problems will be discussed at length, for the subject is too vast and is quite beyond my powers; it will be limited to observations and experiences on a single, rather extraordinary trip from the coast to the summit of Mount Halcon, in north-central Mindoro. This mountain, which attains an altitude of 8,900 feet, had never been conquered, and up to the year 1945, our party is the only one, so far as I know, to have reached its summit.

A single trip up a mountain and a return over the same trail cannot be considered adequate exploration. Although we did collect approximately 600 different species of ferns and flowering plants, this undoubtedly represents not more than one-third or perhaps one-fourth of the species that actually grow on this great mountain. A very high percentage of the flowering plants observed were sterile and of these no collections were made. As the Halcon record stands, one out of every six species collected was new to science. Of the approximately 100 new species described in the preliminary papers on the collection 40 were orchids and 20 were ferns. The overwhelming vegetation of Mount Halcon here discussed would perhaps be paralleled by most of the higher mountains of the Philippines or of Malaysia as a whole, but it is on the unexplored ones

that the botanist will find the high percentages of undescribed species.

The Mount Halcon trip was planned in October, 1906, with the support and cooperation of Major General Leonard Wood, then Commanding General of the Department of the Philippines. The technical personnel consisted of Major Edgar A. Mearns, of the Army Medical Corps, Mr. W. I. Hutchinson, forester in the Philippine Government Service, and the author. Two enlisted men from the United States Army, one a topographer, were assigned to accompany us, and we recruited 15 native carriers through the intermediary of Maximo Ramos, the very efficient Filipino botanical collector of the Bureau of Science, who also went as my assistant.

Leaving the coast at Subaan some distance north of Calapán, our party proceeded inland in a southerly direction through what is always a relatively uninteresting botanical region, that is, waste lands, crudely cultivated areas, open grasslands, bamboo thickets, characteristic second-growth forests, and some heavily thinned primary forests, these types of vegetation resulting largely or wholly from the primitive system of agriculture practiced by the natives. At low altitudes such areas yield little of value to the fern collector, chiefly common and widespread species of the large genus *Dryopteris*, certain common species of *Nephrolepis*, tangles of scandent *Lygodium* in the thickets, occasional epiphytic species such as *Drynaria quercifolia* and *Cyclophorus lanceolatus*, and representatives of a few other genera. Almost invariably the species in such areas are those of very wide geographic distribution.

Climatic conditions in the Mount Halcon region are definitely favorable to fern growth, because the presence of this high isolated peak causes abundant precipitation in its vicinity during all months of the year. Thus one

notes in the mangrove forests along the lower reaches of the rivers that drain this rugged terrain—normally very sterile from the collector's standpoint, because of the monotonous and very limited flora—such striking epiphytic pteridophytes as the Bird's-nest Fern (*Asplenium Nidus* L.) and, often associated with it, the pendent fronds of *Ophioglossum pendulum* L., certain epiphytic species of *Lycopodium,* and *Psilotum complanatum* Swartz. Yet only seven miles distant, across Verde Island Passage, such species will be found on the Luzon side only after one attains an altitude of about 2,500 or 3,000 feet. In marked contrast to the Mindoro coast, just mentioned, where rain falls in all months of the year, the Luzon coast is subject to a period of about six months heavy rainfall and an alternating dry season of similar length when there is normally no rainfall. This seasonal distribution of the rainfall is a very important factor in determining the general types of vegetation that will be found in various parts of the archipelago.

Proceeding inland the party reached and crossed the Binabay River, passed through a tract of elevated forested country, and in due time reached and crossed the much larger Alag River. It was only after the Alag was reached that we commenced to enter the botanist's paradise, for once in the undisturbed primary forest of this exceedingly wet tropical region the abundance and diversity of plant life became very evident; and not the least interesting element in this vegetation complex was the fern flora. Our plan of operation—for we were working in a practically trailless and utterly unexplored region—was to move inland a day's march, establish a camp, and then send our carriers back to the coast for additional supplies; and, as the bulk of the supplies were assembled at an inland point, to repeat the process. This worked all right until after we had crossed the Alag, and then the system broke down because of weather conditions.

At the place of our first crossing, the Alag was a turbulent stream about 100 yards wide, fordable with some difficulty when the water was low, but impassable immediately following rains in the mountainous region that it drained. From this low-altitude crossing (200 ft.) to our last one on the inward journey at an altitude of about 1,200 feet, no quiet stretches were observed along the course of this treacherous stream. It had been our plan to follow the river inland as far as possible or until we struck the basal part of some one of the main ridges leading to the central massif of the mountain, by following which we hoped to reach the summit in due time. But it is one thing to plan, and quite another to carry out a plan when one has to grope one's way through the uncharted mazes of dense tropical forest covering a very rugged terrain. In passing it is pertinent to note that John Whitehead, the British ornithological collector who attempted to ascend this same mountain in the latter part of 1895, approaching it apparently by way of the Baco River, reports a sudden rise of the river, which was about 200 yards wide at his camp site, of over 20 feet in less than 12 hours, an experience that nearly wrecked his expedition before he had even reached the lower slopes of the mountain.

Immediately after crossing the Alag for the first time, where we observed smaller and medium-sized terrestrial and epiphytic ferns belonging to such genera as *Hymenophyllum, Trichomanes, Polypodium, Asplenium, Athyrium, Tectaria, Nephrolepis, Pteris, Lindsaea, Davallia, Humata, Cyclophorus, Campium,* and *Osmunda,* while searching for a possible route up-stream I had my first real fern experience or fern thrill. I discovered that at some distance above the level of the river a well-marked and nearly level bench extended for some distance parallel to the river. This bench was forested, the trees for the most part being well-spaced tropical

Angiopteris palmiformis, on the Lamao River, Bataan Peninsula

giants; but the usual type of undergrowth, consisting of shrubs, young trees, and seedling rattan palms, that one expects to find in the primary forests, was to a large degree replaced by literally thousands of clumps of the gigantic *Angiopteris pruinosa* Kunze, with stout short caudices, and great spreading fronds up to 16 feet in length, the pinnae very glaucous beneath. It fell to my part to lead the procession, and to open a trail for our carriers. The task of opening a trail through these relatively dense thickets of huge ferns remains in my memory, after a lapse of nearly 40 years, as the most noteworthy fern experience on the whole arduous trip—other than, perhaps, the fern-rat episode mentioned below. The stout stipes were as thick as one's wrist, and to open a passable trail all that one had to do was to lop off the great fronds with bolo slashes to right and left as one walked along—the easiest task in trail opening, for a distance of a mile or more, on the whole trip. I could not help but think of the conservatory value of such an array in Europe or in America, and there I was ruthlessly destroying the symmetry of great clumps of this magnificent fern literally by the hundreds, for the trail had to go through. Trail work, as we proceeded inland, at both low and at higher altitudes, was otherwise distinctly arduous, although relatively simple on the mid-mountain forested slopes and ridges, once we reached the mountain proper.

After travelling some distance along the eastern side of the river we reached its junction with a smaller river flowing in from the west, but elected to follow the main stream. Soon, however, we came to a box canyon, which was of such a nature that further progress by that route was obviously impossible; the rushing waters filled the entire stream-bed from one wall to the other. So we returned to the junction with the smaller stream, crossed the Alag again with some difficulty, and established our

main base camp on high land between the two streams. From this point a trail was opened along a forested ridge between the two rivers, until at last we again reached the Alag at an altitude of about 1,200 feet, still in the primary forest, and still in relatively uninteresting country from the standpoint of the fern collector.

After this final crossing of the Alag on our inland journey our troubles began, because the weather, which had been good up to this time, took a turn for the worse, and for the next 13 days, from the time we struck one of the main ridges of Mount Halcon until we reached the summit and returned to the base camp the day before Thanksgiving, rain was continuous, varying from a drizzle to a tropical downpour. We were cut off from the coast; our carriers could bring in no further supplies, because of their inability to cross the Alag; and we were literally "on our own," with our collecting outfits and a limited food supply. But for the fact that later we discovered some Mangyan clearings, the scattered houses having been deserted by their inhabitants at our approach—for the aboriginal Mangyans are timid people—we should have fared badly indeed. In these houses we did find some stored dry corn, and at one place we annexed a nice young pig which went into the pot regardless. On the entire trip, except for meeting a few of the Mangyans on the route inland from Subaan to the Binabay River—one of whom agreed to go along as guide and then disappeared—we encountered not a single representative of this primitive tribe.

Working inland along the main ridge mentioned, and attaining an altitude of 2,500 to 3,000 feet, we reached excellent fern territory. Terrestrial and epiphytic ferns increased in number of species and in the number of individual plants, varying in size from some of the very small filmy ferns (*Hymenophyllum* and *Trichomanes*), and some distinctly small species of *Polypodium*, to char-

acteristic tree-ferns, a half dozen species of *Cyathea*, with great fronds, their trunks at times attaining a height of 25 or 30 feet; and we noted that in the few rather primitive Mangyan houses which we examined these trunks were sometimes utilized as corner posts. Among the epiphytes was the really gigantic *Polypodium heracleum* Kunze, its coarse fronds, eight or nine feet in length, deeply cut by sinuses between the broad lobes. This fern is of the "bird's nest" type, the basal parts, radiating from its compact rhizome being thus adapted to the retention of humus as a method of conserving moisture and at the same time providing some nourishment to the gigantic fronds. Another remarkable epiphyte was the characteristic Staghorn Fern (*Platycerium biforme* Desv.), with its striking trimorphous fronds, two sterile and one fertile. The imbricate, broad, ascending, stiff bractlike sterile fronds, at first green but eventually brownish, form a great bowl-like mass for retaining humus and moisture; and from this mass hang the forked, broad, thin, green second type of sterile fronds, and a smaller number of short, very broad disk-like fertile fronds, the dorsal surfaces of the latter densely covered by a mass of brown spore-cases. Among the other epiphytes were the nidiform *Asplenium cymbifolium* Christ, belonging in the *Asplenium Nidus* group, its broad entire fronds being three to five feet in length and up to six inches wide; also another species (*Asplenium colubrinum* Christ) of the same group, with narrow stiff leaves, its fronds up to about three feet long and less than an inch wide. Species of *Vittaria, Antrophyum*, and other genera became more abundant.

It is on the slopes and exposed ridges in the mossy forest at about 3,000 feet and upward that the fern flora becomes really complex. Here ferns tend to dominate the undergrowth and, with the orchids, to dominate the epiphytic vegetation also. The dense carpet of mosses

and liverworts is always wringing wet, for at these altitudes the terrain never actually becomes dry. The conditions for fern growth approach the optimum as to temperature and humidity. The filmy ferns, both terrestrial and epiphytic, increase in abundance, as well as various species of the Polypodiaceae. Some of the terrestrial filmy ferns of the genus *Trichomanes*, most attractive because of their finely divided fronds, are very abundant, their fronds, in the case of *T. apiifolium* Presl, being sometimes up to a foot and a half in length. The *Hymenophyllum* species are characteristically smaller, but some of the smaller *Trichomanes* species are abundant also, a particularly beautiful one being *T. Pluma* Hook., as well as the very characteristic *T. glaucum* Blume. Over 20 different species in these two genera were collected on this trip.

Among the noticeable smaller and medium-sized species of Polypodiaceae may be mentioned both terrestrial and epiphytic species of *Lindsaea*, epiphytic species of *Polypodium, Scleroglossum, Oleandra Whitmeei* Baker, *Asplenium unilaterale* Lam., *A. normale* Don, two species of *Monogramma*, with their slender, entire, almost grasslike fronds, several species of *Vittaria, Acrosorus*, the peculiar *Prosaptia contigua* Presl and *P. polymorpha* Copel., the curious *Antrophyum callifolium* Blume, and various species of *Lycopodium*, some terrestrial, others epiphytic. A strange-looking plant is the peculiar *Tmesipteris tannensis* Bernh., which is found only on the trunks of tree-ferns (*Cyathea*). It has a rather unusual geographic distribution, having been originally described from the New Hebrides, but now recorded from New Zealand, Samoa, and the higher mountains of the Philippines from Luzon to Mindanao. On the open slopes one sometimes found quantities of erect species of *Selaginella*, the plants about three feet in height.

Among the coarser species in this habitat is the very beautiful *Dipteris conjugata* Reinw., chiefly a terrestrial fern, with characteristically cleft and variously lobed, very broad fronds, glaucous beneath, and in the more exposed places at higher altitudes its var. *alpina* Christ. *Oleandra colubrina* Copel. forms dense thickets with its elongate, rigid, slender stalks and narrow entire fronds, and *Dennstaedtia scandens* Moore, with its very large, finely divided fronds, may also form dense thickets, this scrambling plant being up to 15 feet long.

A much coarser, scandent fern is *Histiopteris incisa* (Thunb.) J. Sm., which also forms dense thickets, as do several species of *Gleichenia*. In addition to these there are several coarse ferns, chiefly tufted forms, such as *Blechnum Patersonii* Mett., *B. egregium* Copel., and *B. vestitum* Kuhn, the most interesting member of this genus being the peculiar *Blechnum Fraseri* Luerss. This is a miniature "tree-fern," not only notable in habit, but in its geographic distribution also. The finely divided, not very large fronds, are borne at the apex of a slender erect stem of finger thickness, about three feet high. It was originally described from New Zealand, and when it appeared in the Philippine collections it was characterized as var. *philippinensis* Christ. It is now known from several Philippine mountains, Mount Kinabalu in northeastern Borneo, and New Zealand; it is to be expected in Celebes, New Guinea, and other islands between Luzon and New Zealand. In comparing Philippine and New Zealand material I can detect no differences worthy of note, and surmise that this Philippine form is merely a "geographic" variety, characterized largely by the remoteness of its northern habitats from New Zealand—a distance of more than 4,500 miles. Various coarse species of *Polystichum, Asplenium, Athyrium, Plagiogyria, Polypodium,* the curious *Hymenolepis platyrhynchos* Kunze, the equally distinctive *Dryostachyum splendens*

J. Sm., *Dicksonia chrysotricha* Moore, and *Cibotium Cumingii* Kunze, and both coarse and delicate species of *Dryopteris* add to the interest and complexity of the fern flora.

Even when we reached the upper main ridge of this previously unscaled mountain and came out on an open heath at an altitude of about 8,200 feet, the ferns and fern allies, appearing in such forms as *Lycopodium halconense* Copel., *Gleichenia dicarpa* R. Br., *Blechnum vestitum* Blume (a rigid dwarfed form), and *Plagiogyria tuberculata* Copel., formed a characteristic part of the high altitude flora. From this open heath we were forced to laboriously open a trail along a narrow ridge for a considerable distance through the dense thickets of elfinwood that characterize such habitats; it was impossible to proceed otherwise through the dense growth of stunted, dwarfed trees, none over 10 feet high, and very wiry shrubs. This was the most arduous trail-cutting on the entire trip, for we were undernourished, all were suffering from cold and exposure, and the rain still fell in torrents. And every so often a bolo stroke would disturb the balance of the large *Nepenthes* pitchers—for this scrambling pitcher-plant was unfortunately abundant in these dense thickets—and our discomfort be increased by unexpected douches of almost ice-cold water. The wet moss cushion covering the ground varied in thickness from a few inches to a foot or more. Finally on the twenty-first day after leaving the coast we stood on the summit of the highest peak of Mount Halcon, at an elevation of 8,900 feet. This, the third highest of Philippine mountains was at last conquered, and at that we were certainly not more than fifteen miles, in a straight line, from our starting point! Then we retreated as fast as possible to our base camp, with the hope that we might be able to recross the Alag and make a connection with our food supply, for we were already

on very strict rations and had more than begun to tighten our belts.

We reached our base camp on the Alag River late in the afternoon of the day before Thanksgiving, practically without food, although we had eaten everything that came our way during the ascent of the mountain, including the great-grandfather of all of the monkeys of Mindoro, an unusually large specimen, whose muscles had been thoroughly toughened over the many years of his existence in swinging through the trees of the Mindoro hinterland. Major Mearns, who was collecting birds and mammals for the United States National Museum, set a line of small traps in the vicinity of the base camp (for the Alag was still "up" and we could not cross it), just to see what he might catch. He reported favorably on the morning of Thanksgiving day, bringing in six wood-rats; one didn't have to be a zoologist to recognize them as rats. Saving the skins and skulls, the rats were broiled, and while they were being prepared I searched the neighborhood for the young croziers of *Athyrium esculentum* Copel., which incidentally is a very delicate vegetable, and the Thanksgiving dinner that Major Mearns, Hutchinson, and myself really enjoyed that day consisted entirely of boiled fern-tips and two broiled wood-rats each. This fern-rat episode stands out in my memory, but this was not the end. On his return to Washington, Major Mearns worked up his zoological collections, and the skins and skulls of the rats, whose flesh we had eaten with gusto on that occasion of thanksgiving, formed the type of a new species, *Rattus mindorensis* Mearns: the next time I saw him I chided him gently, insisting that he should have called it "*esculentus.*" At any rate, I, as mere botanist, can at least claim that I am one of the few living individuals who has actually dined off the flesh of the type (or paratype) of a new species of mammal!

As noted above, we found the Alag unfordable on our return to the base camp. But on Thanksgiving day the storm ceased, and the water level soon began to fall. Taking advantage of this we did succeed in establishing a very crude bridge across the stream, which was not more than a hundred feet across at this point, by felling trees above some projecting boulders so that they lodged against these after they fell; but it was nearly dark when this "bridge" was in place, so we spent the night in camp. A heavy shower in the night caused the water to rise, washing out our laboriously constructed "bridge," and so the next day we had to repeat the performance. The day after that we moved our collections and equipment across the river and, not being burdened by food, worked down-stream on the east bank of the Alag. Farther down-stream the Alag still remained unfordable and we were faced with the possibility of trying to find our way out by following the east bank down to quiet water. But fortunately one of our carriers succeeded in crossing the river at the original fording place and went to the coast for supplies. By December third we had assembled all our material at the original fording place, and on the next day, with considerable difficulty and no small amount of danger, we succeeded in getting across the turbulent Alag for the last time. With one intermediate camp on the ridge between the Alag and the Binabay Rivers, we reached the coast at Subaan on December fifth—tired, bedraggled, thin, more than actually hungry, but happy that in spite of the weather and other handicaps our mission had been an eminently successful one.

In October of the same year I had made an inspection trip with Major General Leonard Wood. One of his guests was Mr. Horace Fletcher of Boston, the originator of Fletcherism, which as I remember involved chewing one's food a certain number of times before swallowing

it. In conversation Mr. Fletcher casually remarked that he thought of botany as a sort of dilettante profession, and I have reflected many times since how I would have enjoyed having him as a companion on the Mount Halcon trip. However, on one of the larger islands of the Sulu Archipelago on which we landed during the inspection trip, I took him along as a sort of collector's assistant, and by the time we got back to the boat, several hours later, well loaded with botanical spoil and forced to wade a distance of a mile or so across a shallow coral reef full of open pits of deeper water, with darkness rapidly coming on, I think he got the impression that the term "dilettante" did not apply to all types of botanical work. At least the Mount Halcon adventure could not be characterized as a pleasure trip, and there wasn't anything about it that savored of dilettantism.

The hardships were soon forgotten, but the pleasant memories remain and among my remembrances is Hutchinson's cheerful quip when we were trying to eat the tough monkey, and at the Thanksgiving celebration where broiled wood-rats were the *pièce de résistance*, "Cheer up! You couldn't buy a meal like this at Delmonico's!"

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ARNOLD ARBORETUM.

A New Doryopteris Hybrid

R. M. TRYON, JR.

There are two proposed hybrids in the genus *Doryopteris*: *D. nobilis* × *sagittifolia* (× *D. hybrida*) and *D. pedata* var. *palmata* × *sagittifolia* (× *D. Duvalii*). The latter, a horticultural plant, is not yet satisfactorily founded since the figure and description[1] are not sufficiently diagnostic to place it with certainty.

I recently received from Fr. J. Eugenio Leite an ample series of specimens that represent a third and new hybrid. It is *D. nobilis* × *pedata* var. *multipartita*. It is interesting to note that the parent species are also involved in the previously known hybrids. Since there were several large and small plants in the collection, the hybrid seems to be self-perpetuating.

× **Doryopteris Leitei**, n. hybr. [*D. nobilis* (Moore) C.Chr. × *pedata* (L.) Fée var. *multipartita* (Fée) Tryon]. —Rhizomate repente, crasso; stipitibus atropurpureis vel nigris, teretibus vel subteretibus; lamina parvula sterilis hastata, margine subintegra, segmentis basalibus brevibus; laminae fertiles magnae, 8–14 cm. longae et latae, pentagonae, segmentis 3-jugis, falcatis, basalibus inferne bilobatis; ala costalis lateribus rectis vel leviter curvatis; gemmae nullae; sori per sinus continui.—In petris prope cataractas, in loco "Campestre" appellato, prope São Salvador, Rio Grande do Sul, Brazil, Jan. 1943, *J. E. Leite* 2233; typus in Herb. Gray.

The rhizome is relatively large and long, as in *D. nobilis;* the stipe atropurpureous to black, and terete or subterete, as in *D. pedata* var. *multipartita*. The margin of the sterile blade and the tips of all of the segments are, as in *D. pedata* var. *multipartita*, shallowly crenulate to entire. Small sterile blades are hastate, with the basal lobes short, as in *D. pedata* var. *multipartita*. The

[1] Rev. Hort. Belge 1897: 563. *fig.* 168.

segments of the blades are broad and the cutting coarse, as in *D. nobilis*. Only in large blades are the basal primary segments lobed on the upper side; the wing between the basal and the second pair of primary segments has parallel or concave sides, as in *D. nobilis*. No proliferous buds are present, as in *D. pedata* var. *multipartita*. The soral lines are continuous around the sinuses, as in *D. nobilis*.

UNIVERSITY OF MINNESOTA.

The Lure of Arizona Rock-ferns

ALICE EASTWOOD

Arizona seems the last place in this country where ferns can be expected to grow since they love shade and moisture, conditions not generally associated with Arizona, whose name even suggests the opposite. Nevertheless, Arizona is rich in ferns, particularly in the fascinating rock-ferns. In Kearney & Peebles "Flowering Plants and Ferns of Arizona," 65 species are enumerated. They are not easy to find, as they appear only during or soon after a wet period and generally are found in shady canyons without roads for automobiles. Then, too, they are infrequent, rarely many species in a single locality, so that looking for the small rock-ferns is almost like looking for a gold mine and has all the allure that inspires the always hopeful prospector. To discover the scientific names of these ferns and be sure of the correctness of your determinations is not a task for an amateur; but the experts are always glad to help, since new data for known species may be learned, and perhaps a species entirely new and without a name may be found or a species not previously known in Arizona may turn up.

I am an amateur among these ferns and never attempt to name any, but generally send them to Mr. Maxon at

the Smithsonian Institution or to Mr. Weatherby at the Gray Herbarium. More than once when I have thought different lace-ferns (*Cheilanthes*) or different woolly ferns (*Notholaena*) to be of the same species from a cursory examination, they have been found to include more than one. Other ferns in Arizona, representing the same genera as those that assume a tropical appearance in the redwood forests of the California coast area, are found in the mountains of Arizona, but they are less luxuriant and less abundant.

March seems the best time for finding the rock-ferns, as they come up after the winter snows are passing. September is also a good month, since the late rains resuscitate the apparently dead. It is in those months only that I have found them; but I have not been in the mountains of Arizona, where they may be more common.

At Prescott, Arizona, a formation of giant boulders known as Granite Dells is a great home for the rock-ferns. I was there once for a day in March and with very little search found four different kinds. Many more may be there, concealed under those big stones. Again in March, when I was a guest of Mrs. Susan Delano McKelvey, we tried to ascend Whitehorse Canyon in the Catalina Mountains in her car, but on account of the snow on the road had to turn back. In a little gully by the side of the road three different rock-ferns were found, apparently having just shed their mantle of snow.

Another March when I was on my way to Silver City, New Mexico, to collect flowering and fruiting specimens of the cottonwood for Prof. C. S. Sargent of the Arnold Arboretum, I stopped over at Tucson, and while there took the train to Patagonia with the intention of walking back to collect plants on the way. Near a bridge along the road in a small canyon, I found the loveliest mossy moisture-laden cliff and in the moss collected three different kinds, little gems of beauty.

The Grand Canyon has always had a fascination for me and I've been down the Hermit Trail once to the river, the Bright Angel Trail several times, and the Grand View Trail to where it ended. The time of year was not promising and I had very little success in finding any ferns. On one trip in late September, after the late summer rains, on the Bright Angel Trail I found *Cheilanthes Feei*, *Notholaena Parryi*, and *Pellaea longimucronata*. When one walks down and up those steep trails, carrying an increasingly heavy press, there is no leisure to search for these inconspicuous plants. After all, whenever I have come across these attractive little ferns I have been thrilled by their unexpected discovery, and always remember the pleasure they gave me and the lovely places where they grew.

CALIFORNIA ACADEMY OF SCIENCES.

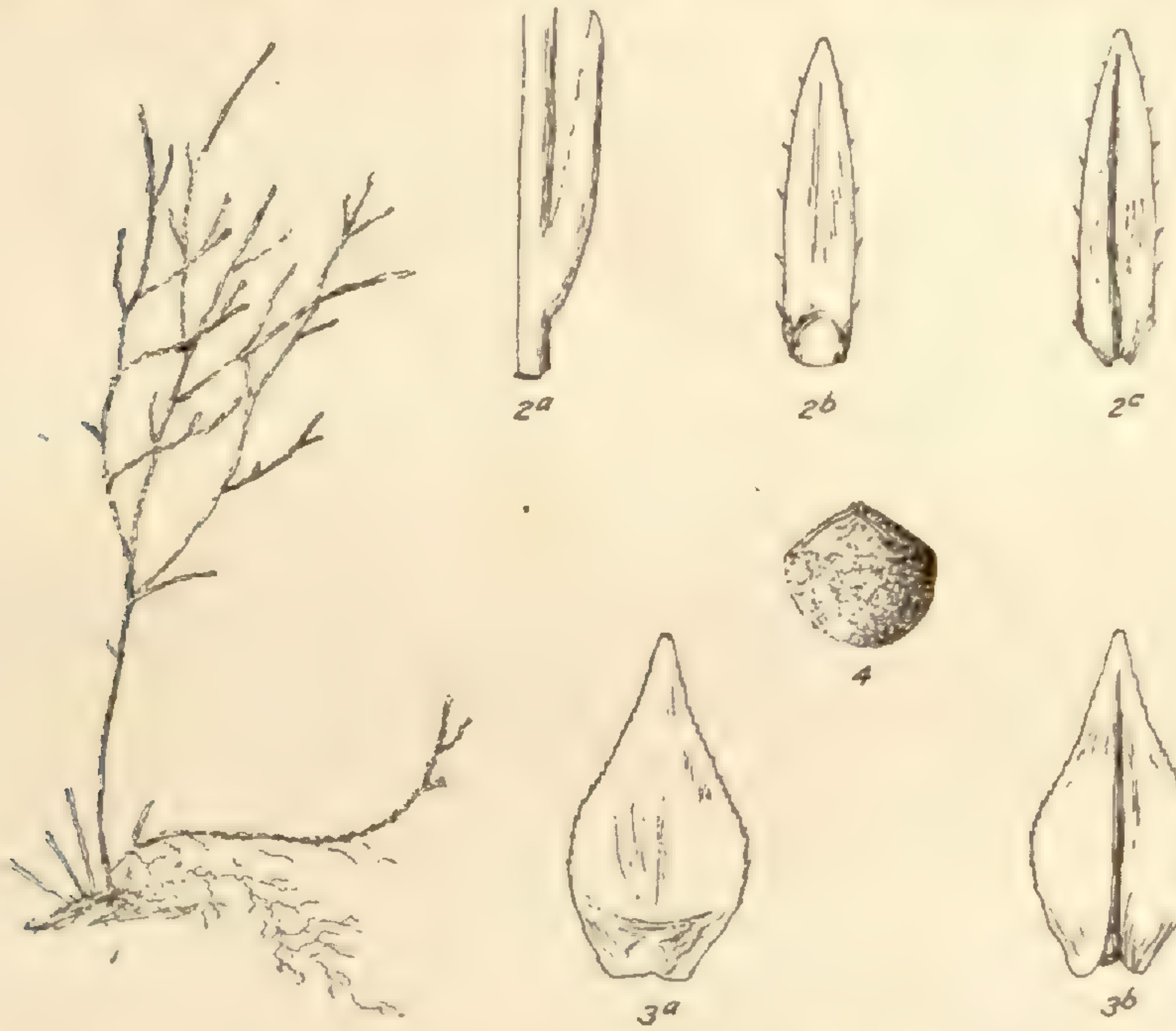
A New Selaginella from Western Texas

C. A. WEATHERBY

Selaginella Coryi, sp. nov. Caules erecti basim versus solum radicantes vel ramis imis prostratis radicantibus, graciles (cum foliis circa 0.75 mm. diametro), in specimine viso ad 10 cm. alti, subsparse bi-tripinnatim ramosi, ramis (imis nonnumquam exceptis) adscendentibus. Folia (siccata) arcte adpressa imbricataque circa sex-serialia, subulato- vel lanceolato-linearia, ca. 1.5 mm. longa, 0.4 mm. lata, crassiuscula, glauco-viridia, dorso convexa et fere ad apicem anguste sulcata, ventro plana. marginibus sparse denticulata vel basim versus brevissime ciliata, basi subabrupte in caulem desinentia, apice subacuta mutica. Spicae ad apices ramulorum gestae ca. 1 cm. longae. Sporophylla deltoideo- vel rhomboideo-ovata, ca. 1.5 mm. longa, 0.8 mm. lata, ad apicem subacutum muticum gradatim angustata, marginibus dense minuteque denticulata, dorso usque ad apicem anguste sulcata. Megaspori flavi, ca. 0.4 mm. diametro, latere commissurali leviter compressi, lateribus ambobus (com-

missurali densius) irregulariter levissimeque rugulosis, rugulis latis, costis commissuralibus haud prominentibus, annulo aequatoriali nullo. Microspori (vix maturi) aurantiaci (luce transeunte flavi), ca. 35 μ diametro, leviter punctati.

TEXAS: North Wall, Chisos Mts., Brewster County, July 10, 1944, *V. L. Cory* 44831, type in Herb. Gray.



SELAGINELLA CORYI, sp. nov.

1, Habit-sketch (× ½); 2a, leaf and stem in profile, somewhat diagrammatic; 2b, leaf, ventral surface; 2c, leaf, dorsal surface (all about × 15); 3a, sporophyll, ventral surface; 3b, sporophyll, dorsal surface (both about × 15); 4, megaspore (× 25).

Mr. Cory writes that his plant "grows rather commonly on the south-facing slope of the north wall of the Basin, just on top of the Chisos Mountains. The soil is rather shallow, and the surface is largely of igneous rock. I presume that this would make it acid rather than alkaline."

As shown in the habit-sketch, the upper branches in *S. Coryi* are all strongly ascending. Near the base of the

stem, however, prostrate branches are produced, which root as they lie along the ground and furnish a means for the spread of the plant and the formation of colonies. The same phenomenon occurs in *S. rupincola* and, Prof. P. A. Munz tells me, also in *S. Bigelovii.*

From the three other species of *Selaginella* of erect growth which occur in the southwestern United States, *S. Coryi* is at once distinguished by its rather thick and convex, muticous leaves. All the others have flatter, awn-tipped leaves. In addition, the leaves in *S. Riddellii* Van Eselt. are more strongly ciliate. In *S. rupincola* Underw. the stems and branches are relatively stout, 2 mm. or more in diameter, and the leaves are 2.5 to 3 mm. long, acuminate, and densely long-ciliate. In *S. Bigelovii* Underw., of California, the leaves are about 2 mm. long and with much more numerous teeth. All the eastern erect species have either awn-tipped leaves, or megaspores smooth on at least one hemisphere. Of the two species of prostrate habit in which the leaves do not have terminal awns, *S. mutica* D. C. Eaton has them broader in proportion to their length, obtuse, and with very long cilia. Technical distinctions between *S. Coryi* and *S. viridissima* Weath. are more difficult to find; but the very different habit of the latter and its longer (1.8 to 2 mm.), bright green leaves set it sufficiently apart.

It is a pleasure to associate this species, one of a considerable number in various groups recently detected in the mountains of southwestern Texas, with the name of its collector, who has added notably to our knowledge of the Texan flora.

I am indebted to my wife for the accompanying illustration.

GRAY HERBARIUM.

Notes on Muhlenberg's Ferns

EDGAR T. WHERRY

In his "Catalog of North American Plants," published in 1813, Muhlenberg listed on pages 97 and 98 a total of 75 pteridophytes. The names of most of them were evidently taken from Willdenow, whose treatment had appeared 3 years previously in volume 5 of his (the fourth) edition of Linnaeus's "Species Plantarum." The few additions and changes made have no standing, because unaccompanied by any discussion. Nevertheless it has seemed of interest to review Muhlenberg's list and discuss certain of the names included. Several of these which had been published as new by Willdenow were regrettably omitted by Broun from the tables of synonymy in his "Index to North American Ferns."

Muhlenberg's fern herbarium was acquired by William P. C. Barton, and ultimately passed to the American Philosophical Society; it is now on deposit at the Academy of Natural Sciences of Philadelphia. Unfortunately Barton lost some specimens and destroyed all but one of such labels as there may have been. In a few cases, however, specimens in this herbarium aid in interpreting names used by Willdenow and Muhlenberg. Those regarded as worthy of comment are here taken up in the same order as in the Catalog.

ACROSTICHUM LINEATUM. This combination, published by Cavanilles in 1799 and recorded by Willdenow (p. 115) but missed by Broun, evidently applied to *Blechnum spicant* (L.) Roth, collected in British Columbia.

POLYPODIUM VIRGINIANUM. Muhlenberg accepted this species epithet for the east-American plant, but added "var. *vulgaris*," indicating that he doubted the specific distinctness of the two related ferns, as have many subsequent workers.

POLYPODIUM CONNECTILE. Michaux had distinguished under this name the American Beech-fern from the European "*Polypodium phegopteris*," and was followed by Willdenow (p. 200) and Muhlenberg. For many years compilers of tables of synonymy ignored it, but Morton[1] has pointed out that under *Phegopteris* it is the tenable specific epithet for the Beech-fern of both sides of the Atlantic. It has recently been taken up by Jones.[2]

ASPIDIUM TENUE. The common east-American Brittle Fern was named *Nephrodium tenue* by Michaux in 1803, the species epithet being transferred to *Aspidium* by Swartz three years later. Willdenow (p. 279) maintained its specific distinctness from "*A. fragile*" of Europe, and was followed by Muhlenberg. The specimens in the latter's herbarium represent what is currently classed as *Cystopteris fragilis* var. *mackayii* Lawson.

ASPIDIUM ASPLENIOIDES AND A. ANGUSTUM. These had been differentiated by Willdenow (pp. 276 and 277) from one another and from *A. filix-femina* of Europe, and Muhlenberg listed both. The lumpers of a century and more refused to accept this plan, but in 1917 Butters pointed out their distinctness and is today generally followed. The Muhlenberg herbarium contains a group of more or less broken fronds, chiefly of what is currently known as *Athyrium angustum* var. *rubellum* (Gilb.) Butters.

ASPIDIUM CICUTARIUM. Mistakenly attributed by Willdenow (p. 216) to Virginia, this was included by Muhlenberg. It is, however, West Indian.

ASPIDIUM RUFIDULUM. This combination, based on *Nephrodium rufidulum* Michx., was made by Swartz in 1806, and was accepted by both Willdenow (p. 282) and Muhlenberg for the fern now known as *Woodsia ilvensis*.

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[1] Rhodora **43**: 219. 1941.
[2] Jones, G. N. Flora of Illinois 37. 1945.

(ASPIDIUM LANCASTRIENSE.) This species epithet was proposed by Sprengel in 1804 in reference to the locality, Lancaster County, Pennsylvania, whence he had evidently received it from Muhlenberg. It was included by Willdenow (p. 261) but curiously enough omitted by Muhlenberg. Perhaps the latter had recognized its identity with what is now known as *Dryopteris cristata* (L.) Gray, of which there is a specimen in the herbarium.

ASPLENIUM RHIZOPHYLLUM. Following this entry Muhlenberg inserted "*B. pinnatifidum.*" In his herbarium there is a typical specimen of the Lobed Spleenwort, inserted in a slit piece of paper bearing the letters "Virg.," which indicates that it came from Virginia. The epithet was first validly published, as *Asplenium pinnatifidum*, by Nuttall in 1818.

ASPLENIUM POLYPODIOIDES. This combination, published by Swartz in 1801 (missed by Broun), had been reduced to synonymy with *A. ebeneum* by Willdenow (p. 329). Muhlenberg, however, listed both species epithets. His herbarium includes a group of rather uniform fertile fronds of what is currently known as *A. platyneuron* (L.) Oakes ex Eaton.

ASPLENIUM MELANOCAULON. Here Willdenow (p. 332) was endeavoring to distinguish an American entity from the European *A. trichomanes* L., and Muhlenberg concurred. Though no longer separated, it is inexcusable that Broun and other compilers have ignored this synonym.

ONOCLEA NODULOSA. After this combination Muhlenberg added "*Struthiopteris Pennsylvanica* Willd." Actually, Willdenow (p. 289) had spelled the species epithet "Pensylvanica," so the first use of the double "n" is to be attributed to Muhlenberg. The American Ostrich Fern has long been known as *Pteretis nodulosa* (Michx.) Nieuwl., but may have to become *P. pensylvanica* (Willd.) Fern.

BLECHNUM ANGUSTIFOLIUM. Willdenow (p. 414) and, correspondingly, Muhlenberg endeavored to separate this from *B. serrulatum*, but it is now regarded as a mere depauperate form of the latter.

OSMUNDA CLAYTONIANA. Here Muhlenberg corrected Willdenow by pointing out the identity of this with *O. interrupta* Michx. On the other hand, he followed Willdenow (p. 98) in accepting *O. spectabilis* as specifically distinct from the European *O. regalis*.

SCHIZAEA TORTUOSA. Attributed by Muhlenberg to Pursh, indicating that the latter had privately stated his intention to use this epithet for what he actually published later as *S. pusilla*.

BOTRYCHIUM FUMARIOIDES. The herbarium contains a specimen of this entity, so named by Willdenow (p. 63) but now known as *B. biternatum* (Sav.) Underw.

BOTRYCHIUM OBLIQUUM. This was described by Willdenow (p. 63) from a specimen sent to him by Muhlenberg. Interestingly enough, the latter's own collection actually includes three fertile individuals. One is a slender plant with the sterile portion badly damaged, apparently representing what is currently known as *B. alabamense* Maxon. Another is a massive plant with broad oblong-ovate segments, the so-called "var. *oneidense.*" There is one, however, corresponding to the diagnosis "leaflets oblong-lanceolate, serrulate, unequally cordate at base."

BOTRYCHIUM DISSECTUM. When Sprengel described this species in 1804 he did not mention Muhlenberg, who was recorded by Willdenow (p. 64) as having proposed the name in correspondence and may have suggested it to Sprengel also. The herbarium contains two typical plants.

LYCOPODIUM ALBIDUM. A mis-spelling of *L. albidulum* Willd. (p. 37), which was stated to have been sent from Pennsylvania, no doubt by Muhlenberg. Neither form of the epithet is listed by Broun or other compilers. In

the herbarium there is a fragment of *Selaginella apoda* (L.) Fern., which corresponds well to Willdenow's description and is no doubt a clastotype. It is unusual in having strobili up to 2 cm. long; its pale color, to which the species epithet refers, is merely a late-season condition.

EQUISETUM ULIGINOSUM. This was described from Pennsylvania material sent by Muhlenberg to Willdenow (p. 4). Unfortunately the herbarium now lacks all Equisetums. The epithet was shifted to varietal status under *E. fluviatile* by A. A. Eaton, and given as a synonym of *E. fluviatile* forma *minus* (Braun) Broun. It evidently represented a plant which in past times occurred along the shores of the Susquehanna River (Muhlenberg's home region) but apparently has been annihilated by modern damming of the river and pollution by coal refuse. It probably deserves infra-specific status under *E. litorale*.

UNIVERSITY OF PENNSYLVANIA AND
ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA.

Additional Notes on Arizona Ferns

WALTER S. PHILLIPS

In a recent number of the Journal[1] the author presented data on three Arizona ferns. The present notes deal with three additional species (one new to the state and two from new stations) and another station for one of the ferns discussed previously.

POLYSTICHUM SCOPULINUM (D. C. Eaton) Maxon

This fern, although suspected to be an Arizona resident, has never been definitely cited from a known station within the state. Last summer in going over material in the Flagstaff State Teachers' College Herbarium, Mr. Chester F. Deaver pointed out a sheet of *Polystichum*

[1] Amer. Fern Journ. 35: 90. 1945.

that was unreported in literature. This specimen, labelled *P. Lonchitis* (L.) Roth, was obviously not that species but *P. scopulinum*. The label indicates that it was collected on Elden Mountain (near Flagstaff, Coconino Co., Arizona) on September 4, 1914, by a student in a taxonomy course (*Marie Collins* 14). The specimen consists of three good fronds of typical *P. scopulinum*, but the rhizome is lacking. A short time after returning from Flagstaff I received from Mr. A. Lefebure a specimen of this fern from Elden Mountain, collected in September 1945, at an altitude of 8,400 feet; it is now in the University of Arizona Herbarium (*Lefebure* 859).

ASPLENIUM SEPTENTRIONALE (L) Hoffm.

Another station for this fern in Arizona was discovered during the summer of 1945. Along the Mogollon Rim (southern Coconino County) about 70 miles southeast of Flagstaff, near Alder Lake, at 8,000 feet, the Rim Road passes along a low north-facing ledge, the face of which is covered with thousands of colonies of this rare plant. A specimen from this collection is in the University of Arizona Herbarium (*Phillips* 2852).

CHEILANTHES PYRAMIDALIS var. ARIZONICA (Maxon) Broun

This fern has been specifically cited in literature only from the Huachuca Mountains of Cochise County. Wiggins[2] in a key to the *Cheilanthes* species of the Sonoran Desert mentions the Chiricahua Mountains in addition to the Huachuca Mountains, but does not give definite citations. In the spring of 1945, during a trip up Rucker Canyon in the southern Chiricahua Mountains of Cochise County, I picked up what appeared to be a frond (from the previous season) of this species. Last fall, on another trip to Rucker Canyon, I was able to verify the identification and to make a good collection of this species (*Phillips* 2858). I found good and numerous

[2] Amer. Fern Journ. 29: 59. 1939.

colonies growing on a shady north slope of the canyon at about 7,000 feet. It seems to be much more abundant here than at the Huachuca Mountain stations reported.

CHEILANTHES LENDIGERA (Cav.) Swartz

Previously this fern was known only from the Huachuca and Chiricahua Mountains in Cochise County. In the spring of 1945 Dr. L. M. Pultz and the author made a trip to Happy Valley, on the eastern slopes of the Rincon Mountains in Pima County. Here the Rincon Mountains have many short steep canyons in which water is abundant in the spring and a trickle is present throughout most of the year. *Cheilanthes lendigera* was found growing abundantly in most of these canyons along the moist ledges near the water at 5,000 feet. Specimens are deposited in the University of Arizona Herbarium (*Phillips & Pultz* 2730, 2750, 2751, 2752). J. C. Blumer[3] once explored these mountains rather carefully and collected many plants from this region, but he evidently overlooked this interesting wide-spread species.

UNIVERSITY OF ARIZONA, TUCSON, ARIZONA.

Recent Fern Literature

Two more of Gualterio Looser's always excellent and scholarly studies of Chilean pteridophytes have recently appeared. One treats of the genus *Notholaena* in Chile,[1] the other of *Lycopodium confertum* Willd.[2]

In the former, Looser recognizes four species (the group of *N. nivea* being assigned, following Prantl, to *Pellaea*). Two of them, *N. mollis*, "the most common fern in all northern Chile," and *N. tomentosa* (*N. hypo-*

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[3] Plant World 13: 134. 1910.

[1] Looser, Gualterio. El genero *Notholaena* en Chile. Darwiniana 7: 62–70, 1 pl. 1945.

[2] Looser, Gualterio. Sobre la pteridofita Argentino-Chilena "Lycopodium confertum." Lilloa 11: 5–13, 4 pls. 1945.

leuca) are well known. Both are endemic, or nearly so; *N. mollis* has been found in extreme southern Peru, but not otherwise outside of Chile. The other two species, *N. aurea* and *N. lepida* (Phil.) Looser (*Cheilanthes lepida* Phil.), are very rare in Chile. The former, a widespread and common Andean species, stops almost entirely, as most such species do, at the desert belt in the north, which there forms, as do the mountains on the east, a barrier that few species have been able to pass, whether migrating out of or into Chile. *N. aurea* has, so far as known, crossed it only at a single station in the province of Atacama.

Of *N. lepida*, Looser supplies an interesting discussion. It is very closely related to *N. sulphurea*, a species occurring at scattered localities from Mexico to Peru and represented from Chile by a single specimen purporting to have been collected on the Chilean side of the Andes by Gillies in 1821. The locality given is on the Transandine Railway, readily accessible and well known to botanists, but no one has yet been able to rediscover the fern there. *N. lepida* is from northern Chile; Looser maintains it, with some doubt, as a species distinct from *N. sulphurea*. The identity of the Gillies specimen rests on my determination, made at a time when I knew nothing of *N. lepida*. Should Looser's maintenance of the latter prove justified, the Gillies plant may prove to belong with it. Or, it might represent a more familiar phenomenon, the southward extension of Andean species along the Argentine side of the Cordillera—in this instance getting a little way into Chile.

In the second article, Looser points out that *Lycopodium confertum*, though clearly described and differentiated by earlier authors, has been by more recent ones, beginning with the younger Hooker, confused with *L. magellanicum* Swartz. Actually, it differs obviously from that species in its superficial main stem and sessile

spikes; *L. magellanicum* has a subterranean stem and peduncled spikes. Looser describes and illustrates a new variety, *L. confertum* var. *Barrosii*, characterized by very long fruiting spikes.—C. A. WEATHERBY, *Gray Herbarium.*

American Fern Society

THE ST. LOUIS MEETING.—The meeting on March 30, 1946 of the American Fern Society, with Vice-President Ewan presiding, began with a discussion of Society field-trips. It was suggested that field trips might advantageously be renewed in connection with possible summer meetings of the American Association and that field trips to large greenhouses or conservatories be considered in connection with the Christmas meetings.

Dr. Dwight W. Moore presented a very interesting paper on the rediscovery of *Pilularia* in Arkansas, the first record since it was found by Thomas Nuttall at Fort Smith in 1819. Dr. Moore also showed an excellent series of kodachromes of the ferns of Arkansas. Various members brought specimens for examination, the more unusual being a hybrid between *Asplenium pinnatifidum* and *A. platyneuron*, furnished by Dr. Moore; a form of *Asplenium pinnatifidum* and forma *laciniata* of *Cystopteris fragilis*, by W. E. Liggett, of St. Louis; and some interesting specimens and nature prints, by Albert Chandler, also of St. Louis. The meeting closed with informal discussion centering about the specimens exhibited.

R. M. TRYON, JR., for the *Secretary*.

The FERN JOURNAL has been brought to the attention of the readers of "The New Yorker," the weekly which centers its attention on New York City, interpreted chiefly as Manhattan. In the April 6th issue, in the "Talk of the Town," occurs the following:

"In a recent shipment of 11,284 copies of American magazines that had been ordered by the Soviet Union, there were only two *New Yorkers* (our issues of December 22 and 29, 1945). This is discouraging. It puts us almost down in the class with *Cheese Reporter* (one copy), *Embalmers' Monthly* (one copy), and *American Fern Journal* (one copy), and takes us out of the class of *Coast Artillery Journal* (95 copies), *Army and Navy Journal* (58 copies), *Military Engineer* (110 copies), and *Industrial and Engineering Chemistry* (802 copies). Another publication that must feel rather foolish is *Los Angeles County Aviation Progress.* You'd think it could have interested Russia in more than one copy, but no—only one."

The FERN JOURNAL is sorry if "The New Yorker" and the other county publication (in California) feel foolish; but after all, purveyors of local chit-chat can't expect world-wide interest in goings-on of purely local concern, even of the two most widely advertised communities in the country. Now the FERN JOURNAL by the very nature of its subject, covers the earth's surface from Alaska to Patagonia, and in time back at least 500 million years to the first appearance of fernlike plants.—R. C. B.

Among the six outdoor courses to be sponsored this year by the Berkshire Museum, Pittsfield, Massachusetts, is one devoted largely to ferns. Called "Flower and Fern Tours," the two Sunday morning trips will be led by Orin P. McCarty, a member of the American Fern Society. On Sunday August 4 he will lead the group to Bartholomew Cobble, where among the limestone outcroppings of the Sheffield plain will be found many of the dainty spleenworts and other lime-loving ferns. A week later, on August 11, the group will visit localities west and north of Pittsfield, to see flowers and ferns of the cool woodlands. Trips will be limited to 12 persons and will leave in front of the museum at 9 A.M., returning by 1 P.M. If there is sufficient demand, additional outings will be scheduled. Transportation will be fur-

nished on these trips. For further information write the Berkshire Museum.

NEW MEMBERS

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Published by the

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American Fern Journal

VOL. 36 JULY–SEPTEMBER, 1946 NO. 3

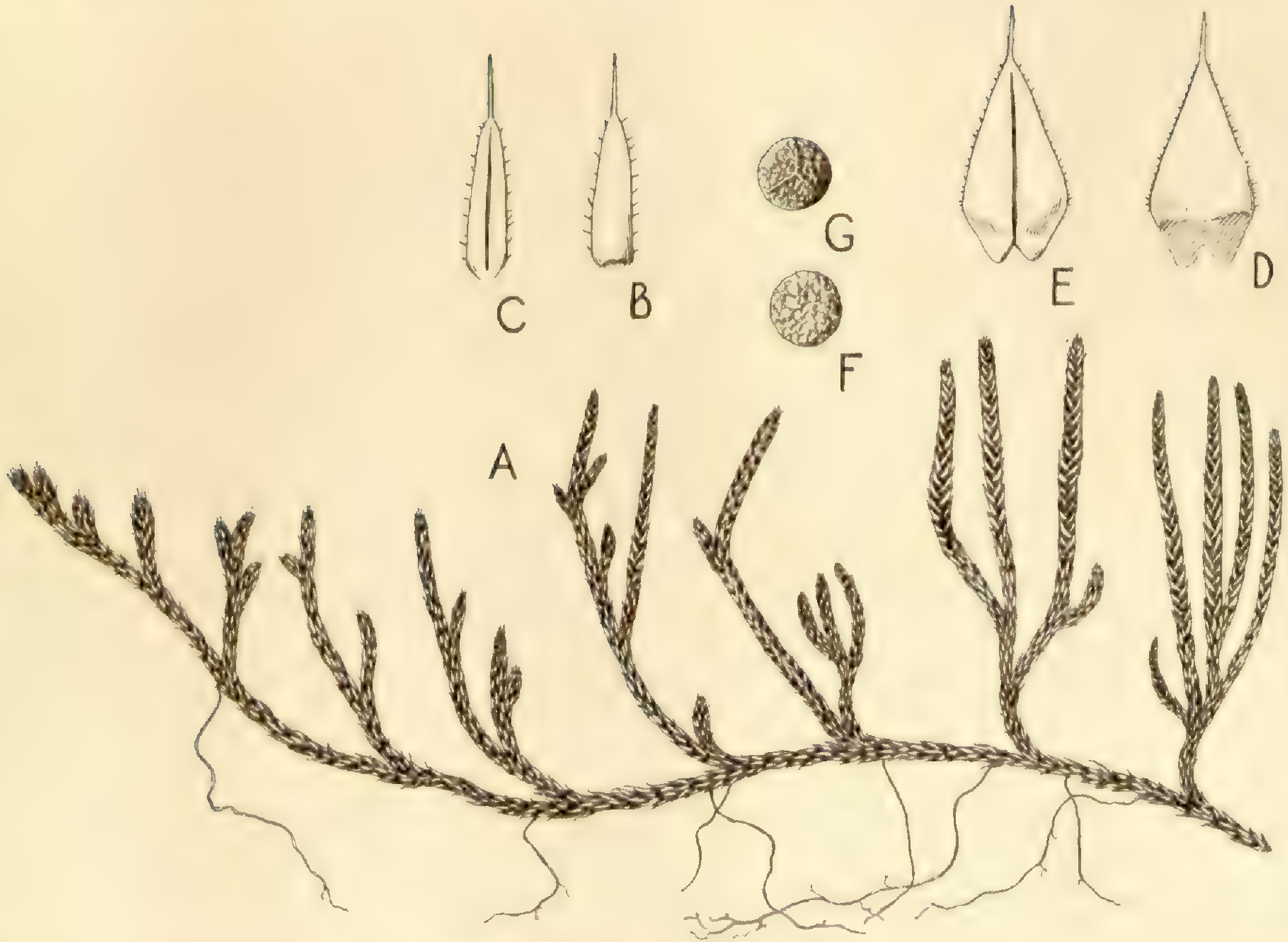
Selaginella, subgenus Euselaginella, in the Southeastern United States[1]

ROBERT T. CLAUSEN

The subgenus *Euselaginella* of *Selaginella* includes species with the leaves and sporophylls uniform, not dimorphous. Van Eseltine (1918) discussed the species of this subgenus in the southeastern United States and Small (1938) included them in his book on the ferns of this area. Van Eseltine recognized seven species, whereas Small considered only three to be worthy of specific status. Reeve (1935) studied the spores of certain North American species, including one *Euselaginella* which ranges into the southeastern states. Likewise Tryon (1946) has given attention to the spores of some of the North American species, but his detailed results have not yet been published.

The present article is based on the rather extensive series of specimens which has accumulated in the United States National Herbarium (US) since the time when Van Eseltine did his work. Also it is based on the many excellent collections made by Drs. McVaugh and Pyron and now stored in the herbarium of the University of Georgia (Ga) at Athens. Besides these collections, I have studied the specimens in the herbarium at the New York Botanical Garden and in the herbarium of the De-

[1] The expense of publication of three of the plates is being defrayed by the Department of Botany of Cornell University. Maps for figures 1 and 3 are from the McKinley Publishing Co. and for figures 2, 4, and 5 from John Wiley and Sons, Inc.
[Vol. 36, No. 2, of the JOURNAL, pp. 33–64, was issued June 5, 1946.]



SELAGINELLA RUPESTRIS

Plant from west brow of Lookout Mt., 10 km. north of Mentone, De Kalb Co., Alabama. A, Habit sketch (×1.7) ; B, ventral surface of leaf (×10) ; C, dorsal surface of leaf (×10) ; D, ventral surface of megasporophyll (×10) ; E, dorsal surface of megasporophyll (×10) ; F, basal surface of megaspore (×17) ; G, commissural face of megaspore (×17). Drawings by Miss Florence Mekeel.

partment of Botany at Cornell University. Thanks are due the curators of these institutions for the privilege of examining their specimens. Also, I wish to express appreciation to Dr. William R. Maxon for his interest and encouragement.

The classification of *Selaginella* is not easy. The endosporic development of the gametophytes may contribute to the complexity of the situation by favoring inbreeding. Although the plants are heterosporous, both types of spores are borne in the same strobilus and no device is known to insure cross-fertilization. This fact should be kept in mind in appraising relationships within the genus.

KEY TO THE SPECIES OF EUSELAGINELLA OF THE SOUTHEASTERN UNITED STATES

A. Megaspores reticulate or rugose-tuberculate basally ..... B.
B. Setae straight; megaspores reticulate basally ..... C.
C. Stems prostrate, creeping, with abundant rhizophores; megaspores reticulate on both faces ..... 1. *S. rupestris.*
CC. Stems erect or ascending, with few rhizophores and these confined to the lower portions of the stems; megaspores reticulate basally, rugose-reticulate on commissural face ..... 3. *S. Riddellii.*
BB. Setae tortuous, often spirally twisted; megaspores rugose-tuberculate basally ..... 2. *S. tortipila.*
AA. Megaspores smooth basally or only slightly rugose or pitted, smooth or rugose on commissural face ..... B.
B. Stems decumbent, including leaves 1–2 mm. in diam.; leaves with short-decurrent bases and usually ciliate dorsally and with setae 0.8–1.3 mm. long ..... 4. *S. acanthonota.*
BB. Stems mostly erect, including leaves 0.5–1.2 mm. in diam.; leaves with long-decurrent bases and usually not ciliate dorsally and with setae 0.5–1 mm. long ..... 5. *S. arenicola.*

Extreme or typical plants of the species included in the key should be readily identifiable. Other plants, particularly those intermediate between *S. acanthonota* and *S. arenicola*, will not exactly agree with the characteristics given for either species.

1. SELAGINELLA RUPESTRIS (L.) Spring. (*Pl. 2, fig. 1.*) Prostrate perennial with the stems branched, creeping, attaining a length of 15 cm. or more, stout, 1.5–2.5 mm.

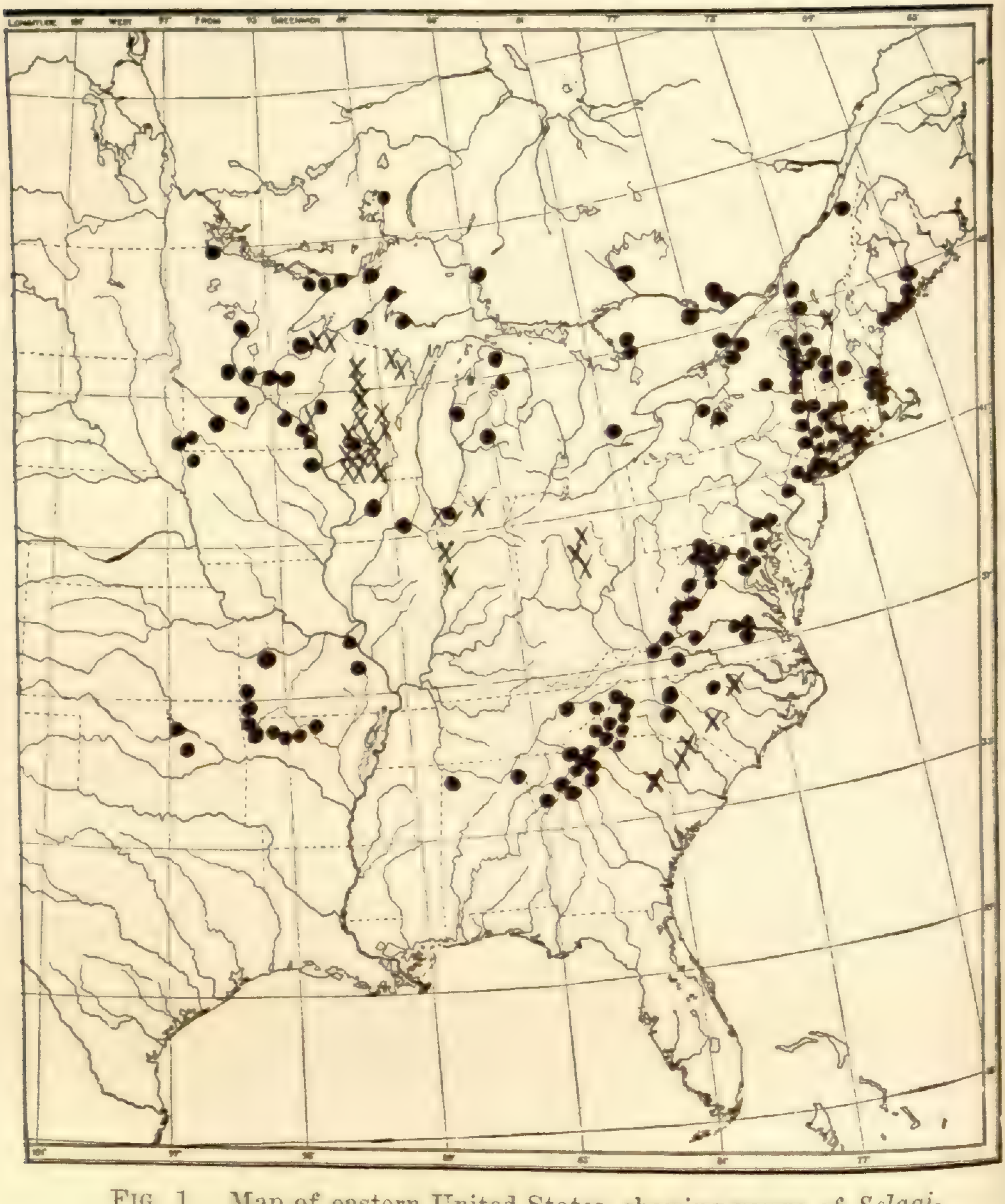


FIG. 1. Map of eastern United States, showing range of *Selaginella rupestris*. ● = specimens seen, × = records from literature. The species occurs northeastward to Nova Scotia, an area not shown on the map.

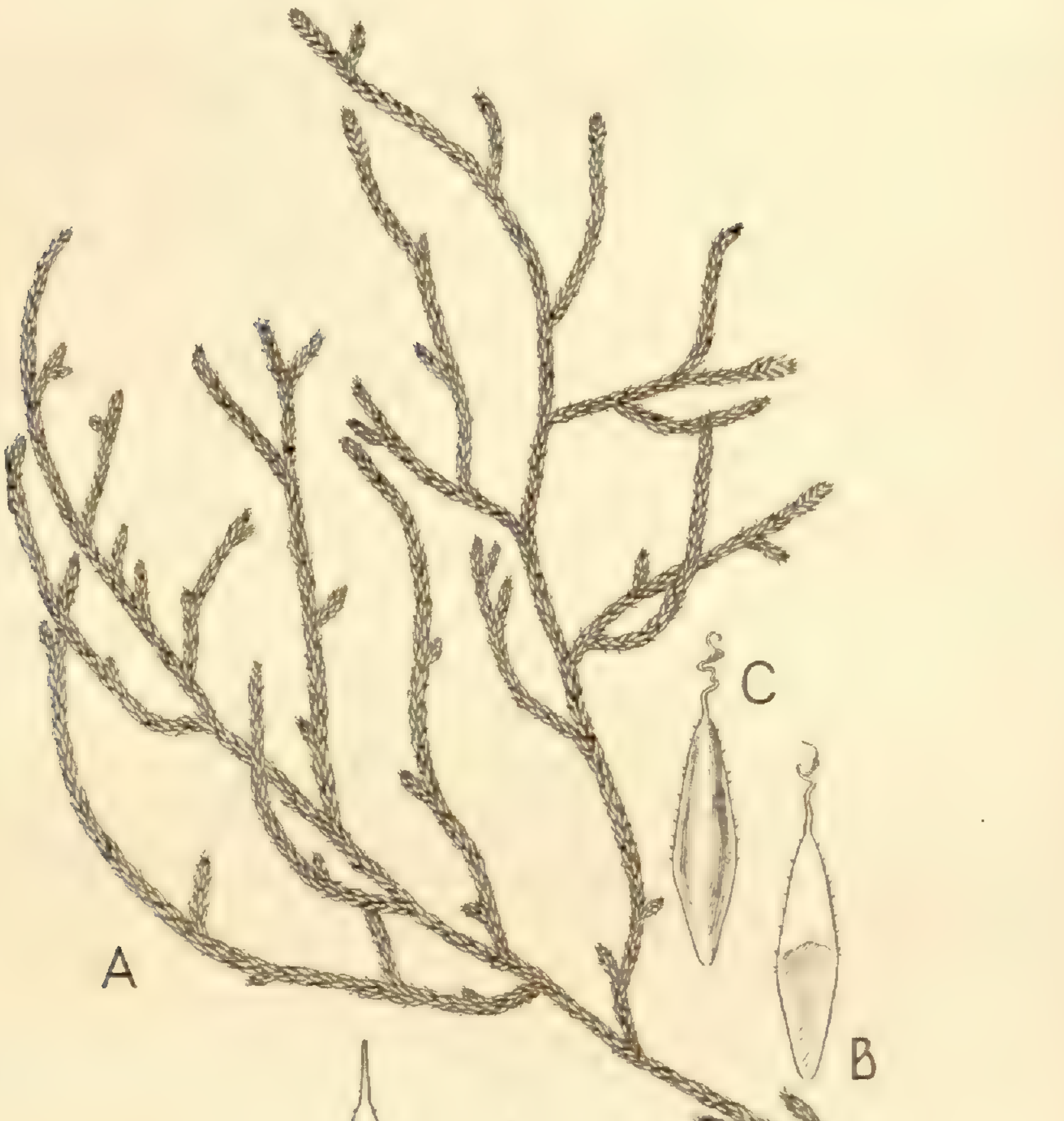
in diam. with the leaves; rhizophores frequent, 1–6 cm. long; leaves alternate, spirally arranged in several ranks, appressed, flat or subconvex dorsally, prominently sulcate, ciliate, glabrous dorsally, 1.4–2.0 mm. long, 0.3–0.4 mm. wide, terminating in straight or nearly straight white setae 1–1.5 mm. long; strobili prominent and well developed, 0.7–2 cm. long, on branches to 5 cm. long; sporophylls ovate-lanceolate, 1.5–2 mm. long, 0.8 mm. wide, terminating in setae 0.4–0.6 mm. long; microspores deep yellow, 0.04–0.06 mm. in diam.; megaspores creamy white, 0.3–0.5 mm. in diam., coarsely reticulate.

Selaginella rupestris ranges throughout most of eastern North America, occurring on rocks, mostly in exposed situations, rarely in sand. The complete range is from Nova Scotia, southern Quebec, Ontario, and northern Minnesota south to northern Georgia, Alabama, Arkansas, and Oklahoma. Since it usually occurs on rocks, it is commonest in mountainous regions and on bluffs along streams in areas of slight relief. It seems rarest on the flat Coastal Plain, where it is known from few localities. The detailed discussion of distribution applies only to the states in the area covered by this article.

NORTH CAROLINA. Frequent in the Blue Ridge and the Northern Piedmont region. I have seen specimens from Buncombe, Burke, Forsyth, Haywood, Orange, Polk, Rowan, Rutherford, Transylvania, and Watauga Counties. Blomquist and Correll (1940) reported it from Franklin and Harnett Counties on the Coastal Plain.

SOUTH CAROLINA. Known from the Piedmont and the inner edge of the Coastal Plain. I have collected it in Greenville County. Miss Mathews (1941) reported it from Chesterfield, Lee, and Lexington Counties.

GEORGIA. Frequent in the northern counties in the Blue Ridge and Piedmont Plateau. Specimens are available from Barrow, Cobb, Fulton, Jackson, Lumpkin, Rabun, Stephens, Union, and White Counties.



SELAGINELLA TORTIPILA

Plant from southern Appalachian Highlands. A, Habit sketch (×1); B, ventral surface of leaf (×10); C, dorsal surface of leaf (×10); D, ventral surface of megasporophyll (×10); E, dorsal surface of megasporophyll (×10); F, basal surface of megaspore (×17); G, commissural face of megaspore (×17). Drawings by Miss Florence Mekeel.

FLORIDA. A collection (US) of Chapman, labelled as from Gadsden County, possibly originated elsewhere. Unless the species is re-collected in this region, it should not be included in the list for Florida.

ALABAMA. De Kalb and Franklin Counties.

TENNESSEE. Known only from the eastern counties: Cocke, Knox and Unicoi.

ARKANSAS. Known only from the northwestern part of the state. Moore (1940) has reviewed its status.

Linnaeus treated this species as *Lycopodium rupestre* on p. 1101 of the first edition of Species Plantarum, 1753. The habitat was designated as Virginia, Canada, and Siberia. According to B. D. Jackson (1912), a specimen is available in the Linnaean Herbarium. Spring in 1838 published the binomial, *Selaginella rupestris*, in Flora **21**: 149, but he did not directly refer to the basinym. A synonym is *Stachygynandrium rupestre* (L.) Beauv., "Prodr. Aethéog. **113**" (1803).

The distinctive features of *S. rupestris* are the prostrate stems, with abundant rhizophores and reticulate megaspores. Over most of its range it seems remarkably uniform. Attempts to delimit and define subspecies have been unsuccessful.

2. SELAGINELLA TORTIPILA A. Br. (*Pl. 3, fig. 2.*) Cespitose perennial with the stems much branched, erect or decumbent, 5–25 cm. high, with leaves 0.6–1.5 mm. in diam.; rhizophores few, only at base of stem, 0.3–3.5 cm. long; leaves alternate, spirally arranged in 6–10 ranks, appressed or loosely imbricate, linear-lanceolate, convex dorsally, not or weakly sulcate, entire or sparsely ciliate, 1.4–2.0 mm. long, 0.3–0.7 mm. wide, terminating in tortuous, spirally twisted setae 0.6–1.6 mm. long; strobili inconspicuous, 2–5 mm. long; sporophylls ovate-lanceolate, terminating in short, often spirally twisted setae, 1.2 mm. long, 0.8 mm. wide; microspores bright yellow, 0.04 mm. in diam.; megaspores pale yellow, 0.4 mm. in diam., rugose-tuberculate.

Selaginella tortipila occurs on exposed granitic rocks in the southern portion of the Piedmont Upland and at low and middle elevations in the Southern Blue Ridge. It is the only species of *Selaginella* endemic in the Appalachian Highlands. Its altitudinal range is from about 90 meters at Heggie's Rock, Appling, Columbia Co., Ga., to 1524 meters on the summit of Tatoola Mt. near Highlands, Macon Co., N. C. The northernmost locality from which the species is known is Grandmother Mountain, Avery Co., N. C. The southernmost locality is 8 km. east of Camak, Warren County, Georgia.

NORTH CAROLINA. Avery, Burke, Henderson, Jackson, and Macon Counties.

SOUTH CAROLINA. Greenville and Pickens Counties.

GEORGIA. Columbia and Warren Counties.

TENNESSEE. Unicoi County: Nolichucky Bluffs near Erwin.

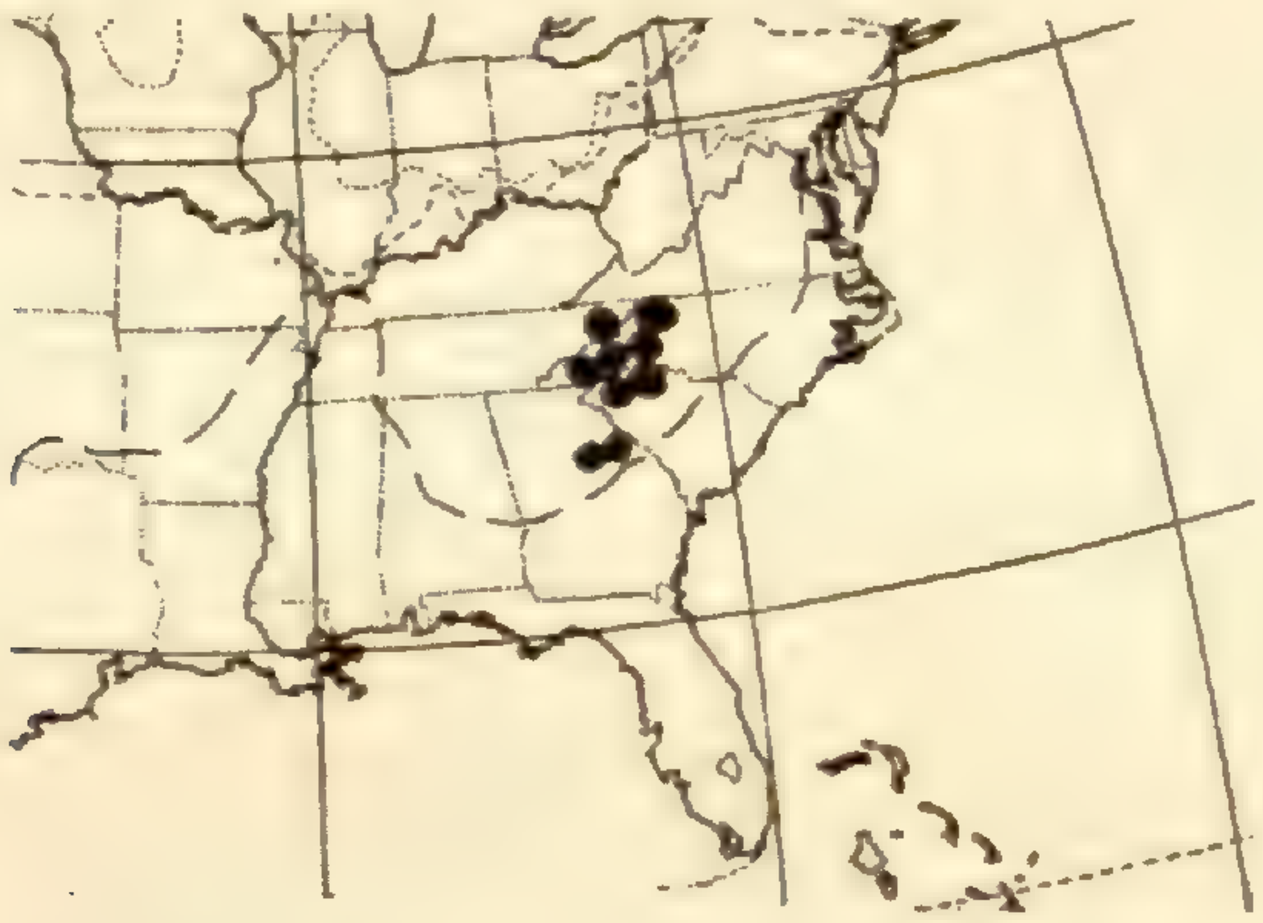


FIG. 2. Map of southeastern United States showing range of *Selaginella tortipila*. The broken line indicates the fall line.

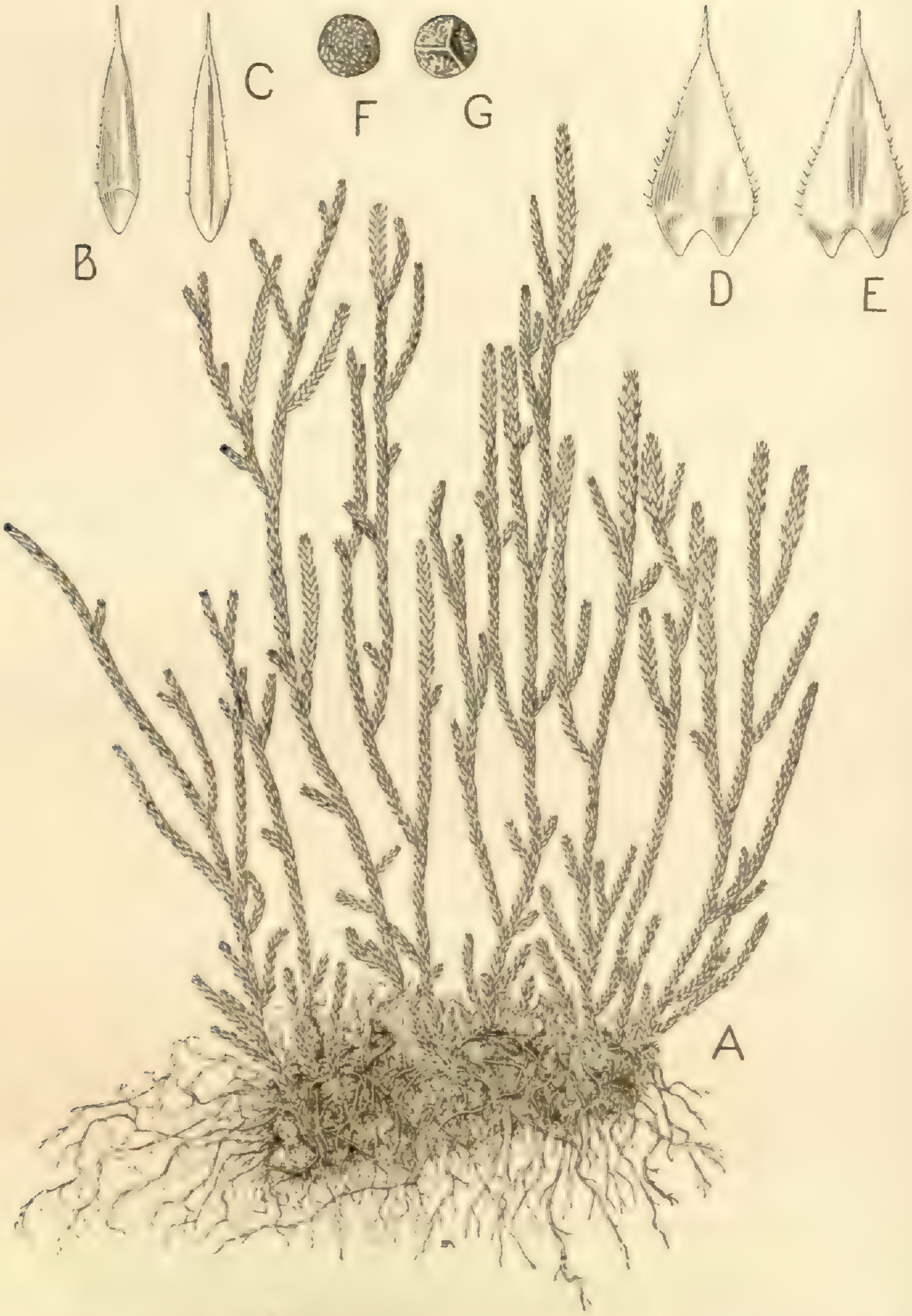
Selaginella tortipila was described by A. Braun in Ann. Sci. Nat., ser. 5, **3**: 271 (1865). The type, collected by Curtis, is from South Carolina. Braun also cited Rugel's collection from North Carolina. A duplicate of the latter is available in the herbarium at the New York Botanical

Garden. Synonyms are *S. rupestris* var. *tortipila* (A. Br.) Underw., Native Ferns, ed. 3, p. 140 (1888); *S. Sherwoodii* Underw., Torreya **2**: 172 (1902); and *S. rupestris Sherwoodii* Clute, Fern Allies p. 142 (1905).

3. SELAGINELLA RIDDELLII Van Eseltine. (*Pl. 4, fig. 3.*) Cespitose perennial with stems branched, erect or ascending, 2.5–10 cm. high, with leaves 0.7–1.2 mm. in diam.; rhizophores few, 1–5 cm. long; leaves alternate, appressed or subdivergent, imbricate, linear-lanceolate, sulcate dorsally along the median line, sparsely but prominently ciliate, 1.5–2 mm. long, 0.2–0.3 mm. wide, terminating in setae 0.3–0.8 mm. long; spikes quadrangular, 0.5–2.5 cm. long; sporophylls lanceolate, auriculate at base, ciliate and with terminal ciliolate setae, 2 mm. long, 1 mm. wide; microspores deep orange, 0.05 mm. in diam.; megaspores white or yellowish, reticulate basally, rugose-reticulate on the commissural side, 0.4–0.5 mm. in diam.

FIG. 3. Map of southeastern United States showing the range of *Selaginella Riddellii.*

Selaginella Riddellii is known from northern Alabama, western Louisiana, eastern and central Texas, and southern Oklahoma. One collection in the United States National Herbarium is labelled as having been obtained by E. N. Plank, in Sept., 1895, at Las Vegas, New Mexico. Dr. Maxon has questioned the data on the label, since Las Vegas is so remote from other known localities for the species. Further collecting is necessary to clarify



SELAGINELLA RIDDELLII

Plant from Cullman County, Alabama. A, Habit sketch (×1); B, ventral surface of leaf (×10); C, dorsal surface of leaf (×10); D, ventral surface of megasporophyll (×10); E, dorsal surface of megasporophyll (×10); F, basal surface of megaspore (×17); G, commissural face of megaspore (×17). Drawings by Miss Elfriede Abbe.

this record. The habitats of *S. Riddellii* are diverse: in sand, on sandstone, or on granite; but no morphological differences are apparent in plants from these dissimilar situations. In all cases the slender erect stems and rugose-reticulate megaspores are distinctive.

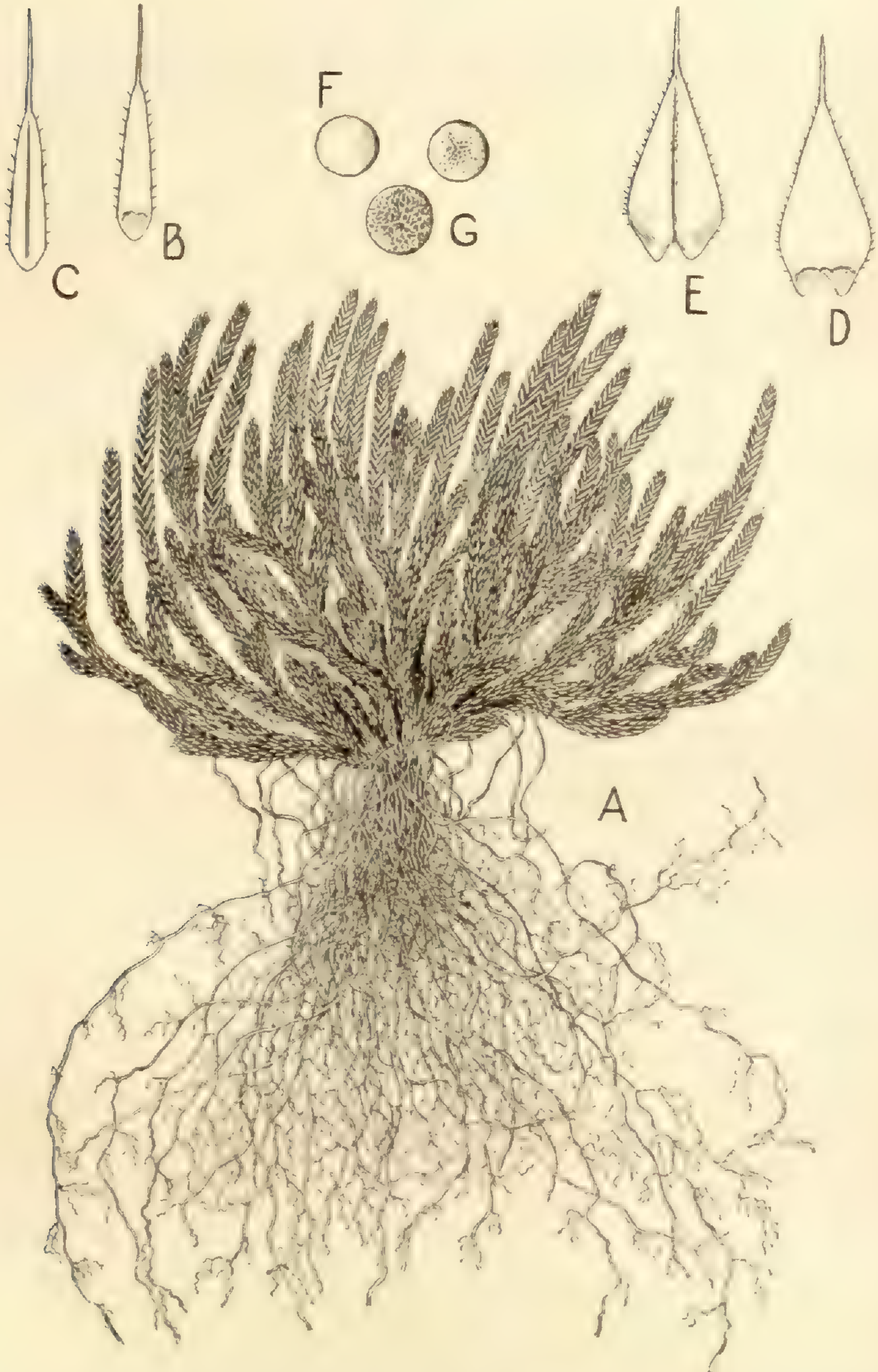
ALABAMA. R. M. Harper has collected this species in the northwestern and north-central part of the state on flat sandstone near Eight-mile Creek and at Cullman in Cullman County, also a mile northeast of Hamilton in Marion County and in Franklin County. His specimens have been variously identified as *S. arenicola*, *S. Riddellii*, and *S. tortipila*. The megaspores, which are reticulate basally, and the straight setae favor *S. Riddellii* as the correct identification.

LOUISIANA. Known from a few localities in Natchitoches Parish.

Selaginella Riddellii seems close to *S. arenicola*, but differs in its megaspores, which are prominently reticulate basally and rugose-reticulate on the commissural face. Those of *S. arenicola* are almost smooth or slightly rugose or pitted. Such a difference may be due to multiple genetical factors. In view of this difference and the absence of morphological intermediates, the two populations may be maintained as separate species. As far as present data indicate, the ranges of the two are disjunct.

Van Eseltine described *S. Riddellii* in Contr. U. S. Nat. Herb. **26**: 162 (1918). The type, no. 690,149 in the United States National Herbarium, was collected near Prairie View, Waller County, Texas, by F. W. Thurow, no. 7.

4. SELAGINELLA ACANTHONOTA Underwood. (*Pl. 5, fig. 4.*) Cespitose perennial with much-branched decumbent stems, attaining a height of 6 cm., including leaves 1–2 mm. in diam.; rhizophores numerous, 1–9 cm. long; leaves alternate, appressed, imbricate, linear-lanceolate, sulcate dorsally along the median line, prominently ciliate on the



SELAGINELLA ACANTHONOTA

Plant from Chesterfield County, South Carolina. A, Habit sketch (×1.7); B, ventral surface of leaf (×10); C, dorsal surface of leaf (×10); D, ventral surface of megasporophyll (×10); E, dorsal surface of megasporophyll (×10); F, basal surface of megaspore (×17); G, commissural face of megaspore (×17). **Drawings by Miss Florence Mekeel.**

margins and usually along the dorsal groove, 1.5–2 mm. long, 0.3–0.4 mm. wide, terminating in ciliolate setae 0.8–1.2 mm. long; strobili quadrangular, 1–3 cm. long; sporophylls lanceolate, auriculate at base, ciliate and with terminal setae, 2–2.5 mm. long, 1 mm. wide; microspores deep orange, 0.05 mm. in diam.; megaspores white or yellowish, smooth basally or sometimes slightly pitted, usually rugose on commissural face, 0.4 mm. in diam.

Selaginella acanthonota is confined to the Coastal Plain. It is known from southeastern North Carolina to southern Florida.

FIG. 4. Map of southeastern United States showing the range of *Selaginella acanthonota*. The broken line indicates the fall line. • = specimens seen, + = records from literature.

NORTH CAROLINA. Bladen, New Hanover, and Robeson Counties. Also reported by Blomquist and Correll (1940) from Columbus and Pender Counties.

SOUTH CAROLINA. Chesterfield, Horry, and Lexington Counties, also reported by Matthews (1941) from Richland County. I doubt the report from Paris Mountain in Greenville County, a locality which I have visited and where *S. rupestris* is common.

GEORGIA. Coffee, Dooly, Emanuel, Johnson, Laurens, Montgomery, Tattnall, and Washington Counties.

FLORIDA. Broward, Dade, Glades, Highlands, Lake, Manatee, Orange, Osceola, Pinellas, Polk, Seminole, and Volusia Counties.

Selaginella acanthonota was described by Underwood in Torreya **2**: 172 (1902). The type, preserved at the New York Botanical Garden, was collected by C. L. Williamson in July, 1892, in pine barrens near Wilmington, N. C. Synonyms are *S. rupestris acanthonota* (Underw.) Clute, Fern Allies, p. 142 (1905); *S. humifusa* Van Eseltine, Contr. U. S. Nat. Herb. **26**: 165 (1918); and *S. floridana* Maxon, Amer. Fern Journ. **11**: 1 (1921).

Selaginella acanthonota and *S. arenicola* are the two species of the southeastern states which afford the most difficulty for the classifier. The former is characterized by having the stems decumbent and stout, the leaves pubescent along the dorsal groove, and the terminal setae of the leaves ciliolate. These distinctions do not always hold, however, and certain specimens appear intermediate. Some of the intermediates have been called *S. floridana*. In annotating specimens I have assigned each to the species which it most resembles, realizing that some are intermediate and perhaps not referable to either species. Since the relationships of *S. acanthonota* and *S. arenicola* are still not clearly understood, I am not subjecting them to a new taxonomic treatment or nomenclatural revision. *S. acanthonota* is the only one in the Carolinas. In most of coastal Georgia and in peninsular Florida both species occur in similar habitats, and in their extreme condition differ in several respects. In less extreme condition they seem to intergrade imperceptibly and to be poorly differentiated. If there is any isolating mechanism which is functioning to keep the two populations partially distinct, it must still be found. Likewise, if *S. acanthonota* and *S. arenicola* are physiological variants of the same species, that fact must be deter-

mined. Without adequate data, I am inclined to continue recognition of both species, simply expressing doubt as to their validity.

5. SELAGINELLA ARENICOLA Underwood. (*Pl. 6, fig. 5.*) Cespitose perennial with stems branched, erect or ascending, 3–12 cm. high, including leaves 0.5–1.2 mm. in diam.; rhizophores few, 0.5–9.0 cm. long; leaves alternate, appressed, imbricate, linear-lanceolate, sulcate dorsally along the median line, sparsely but prominently ciliate on the margins, but usually not along the dorsal grooves, 1.5–2.0 mm. long, 0.3–0.4 mm. wide, terminating in ciliolate setae 0.3–1 mm. long; strobili quadrangular, 0.5–3 cm. long; sporophylls lanceolate, auriculate at base. ciliate and (with terminal setae) 1.5–2 mm. long, 1.0–1.5 mm. wide; microspores deep orange, 0.05 mm. in diam.; megaspores white or yellowish, smooth or almost so, sometimes slightly rugose or pitted, 0.4–0.5 mm. in diam.

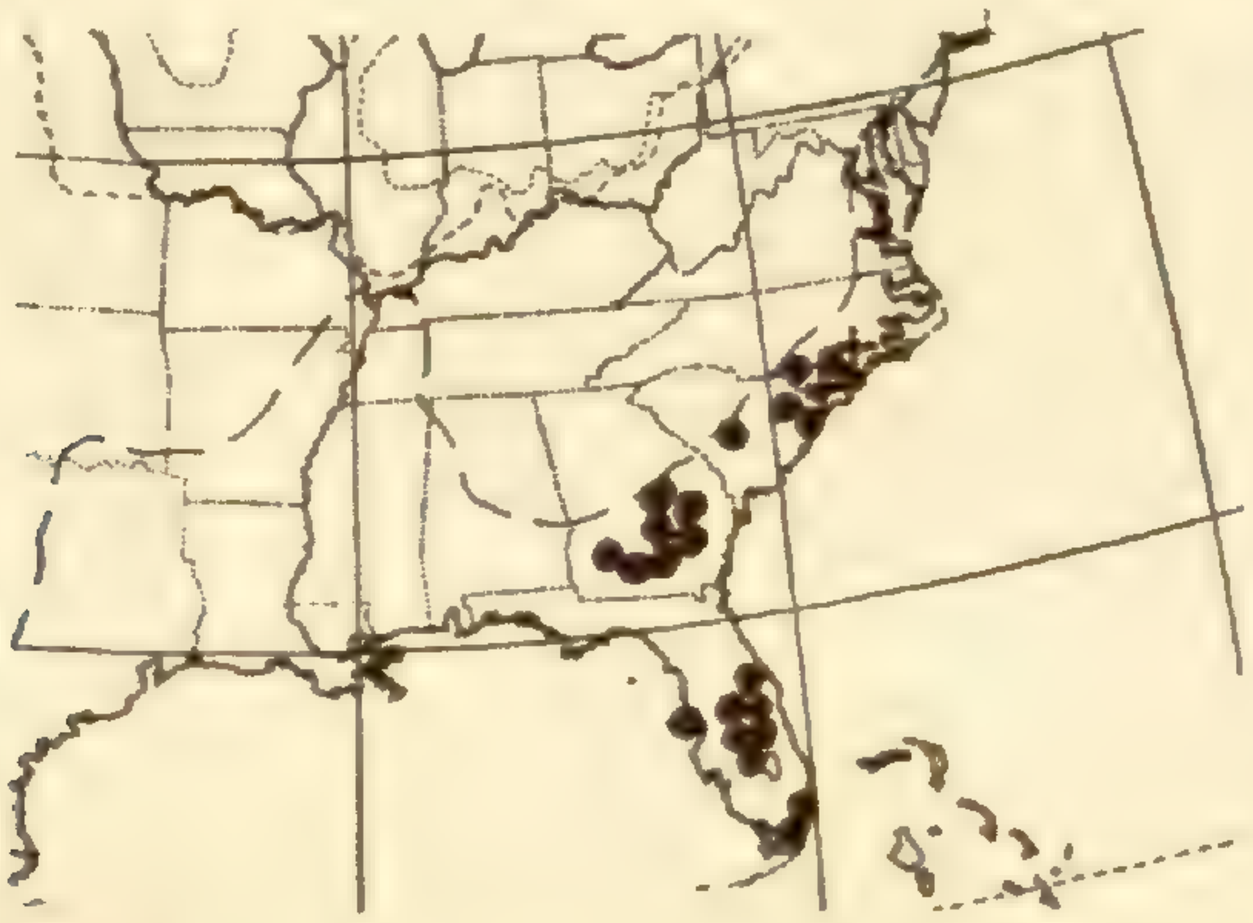


FIG. 5. Map of southeastern United States showing the range of *Selaginella arenicola*. The broken line indicates the fall line.

Selaginella arenicola is known from the Coastal Plain of Georgia and Florida. The northernmost known locality is near Swainsboro, Emanuel County, Georgia, *Pyron & McVaugh* 3221 (Ga 16,801). The southernmost locality is in pinelands near Homestead, Florida, *L. A. Fennell* (US 1,600,291). Westward the species is known only as far as the Appalachicola River at Chattahoochee, Gads-

SELAGINELLA ARENICOLA

Plant from Tattnall County, Georgia. A, Habit sketch (×1); B, ventral surface of leaf (×10); C, dorsal surface of leaf (×10); D, ventral surface of megasporophyll (×10); E, dorsal surface of megasporophyll (×10); F, basal surface of megaspore (×17); G, commissural face of megaspore (×17). Drawings by Miss Florence Mekeel.

den Co., Fla., *A. H. Curtis* (US 723,894). This is about 400 km. from the nearest locality for *S. Riddellii*. *S. arenicola* is a plant of open sandy places. Usually it grows in pure sand. Rarely it occurs on granite.

GEORGIA. Candler, Decatur, Dougherty, Emanuel, Johnson, Laurens, Muscogee, Tattnall, Toombs, Treutlen, and Turner Counties.

FLORIDA. Broward, Collier, Dade, Franklin, Gadsden, Hernando, Highlands, Lake, Manatee, Martin, Orange, Pinellas, Polk, Putnam, and Sarasota Counties.

Underwood described *S. arenicola* in Bull. Torrey Club **25**: 541 (1898). *S. arenaria* Underw., *op. cit.*, p. 129 (1898, not Baker, 1883), is a synonym; also *S. funiformis* Van Eseltine, Proc. Biol. Soc. Washington **30**: 161 (1917). The type of *S. arenicola* is part of Underwood's own collection, no. 1355, Jan. 15, 1891, from near Eustis, Lake County, Fla. It is preserved at the New York Botanical Garden.

SUMMARY

Five species of *Euselaginella* are native in the southeastern United States. One of these, *S. acanthonota*, is only doubtfully distinct from *S. arenicola*. The five species are differentiated on a basis of the megaspores, habit, and the condition and pubescence of the leaves. Three of the species, *S. tortipila*, *S. arenicola*, and *S. acanthonota*, are endemic in the region.

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DEPT. OF BOTANY, CORNELL UNIVERSITY.

Memorabilia Filicum Panamensium

ROBERT E. WOODSON, JR.

A resounding Latin title will indicate as well as any other how tightly my tongue is pressed in my cheek as I prepare to share with any readers of the Fern Journal who may be interested a few of my recollections of ferns in Panama. At the outset I wish to make it clear that so far as ferns are concerned I consider myself a "rank amateur of the first rank." What I have to say may illustrate, nevertheless, the fascination which this group has for even the most obtuse of us.

Well I remember my first introduction to the ferns of Panama—the immense, simply pinnate, leathery fronds of *Acrostichum danaeifolium* in the swampy ground and shallow water all along the Panama Railroad right-of-way between Colón and Panama City. From the train window, I thought they were cycads! That will show you how green I was, and how excited.

A few days later, when I made my first, snake-wary excursion into the forests, my eyes popped at the wealth of epiphytes, particularly ferns. When one reads of tropical forests, so much emphasis is placed on the epi-

phytes that he fears his first personal encounter with them may be disappointing, but this was not the case with me. My first visit to nearly virgin rain-forest thrust upon me almost a stupefying array of ropelike lycopods hanging from the branches. Yes, and a few tufts of *Psilotum nudum,* looking disgracefully like wisps of some moldy old broom.

And filmy ferns, chiefly species of *Trichomanes,* literally plastered the tree trunks! Plastered is the word, because the slender matted rhizomes or prostrate fronds were so closely attached to the bark that I had to take a hunting knife to pry or hack off chunks for specimens. Here I first realized how appropriate it is to call them filmy, for the pale green fronds of several species were so transparent in the green half-light of the forest that one could read print through them, and droplets of moisture were plainly visible on their lower faces. No wonder some botanists have considered them to be connecting links between the ferns and the algae or the liverworts. The way the "filmies" are massed upon their tree trunks is best likened to a kelp-studded rock. In fact, the Swedish botanist Swartz named one of them *Hymenophyllum fucoides!*

But speaking of epiphytic ferns, a prize of some sort should be awarded to *Polypodium ciliatum.* This little vinelike pest grows so profusely upon branches and twigs of cocoa trees in plantations near Almirante that the vigor and yield of fruit are seriously reduced. In fact, this fern has earned the local name *mata rama* (branch killer), and I did not succeed in convincing my plantation friend, Hugh J. Bartlet, that "ferns just aren't parasites."

In slightly more open places in the forests are the tree-ferns, chiefly species of *Alsophila* and *Cyathea,* looking for all the world like the pictures in the book. Their

broad, palmlike crowns with a center of coiled young fronds all facing one another still remind me of a nest of fledgling bull-fiddles.

Mention already has been made of the huge, marsh-dwelling *Acrostichum danaeifolium,* which frequently is associated with the similar *A. aureum.* The only other truly aquatic ferns that I have encountered are the common "water celery" (*Ceratopteris pteridioides*), *Azolla, Salvinia radula,* and perhaps other species of the last genus. These form colonies along the margin of shallow ponds, frequently associated with duckweed and water-hyacinth. In temporary pools one occasionally may find the widespread *Marsilea polycarpa,* and in one such we were fortunate to find in addition the type specimens of *Isoëtes panamensis.*

The ferns of Panama provide a significant sample of the geographical affinities of the vegetation as a whole. Being the pteridological novice that I am, I base my conclusions entirely upon the determinations of Dr. Maxon and his notes concerning new records. In the flowering plants it certainly is true that the geographic affinities of the Panama flora are predominantly with South America, particularly the Andes; Mexico and Central America and the Antilles play a minor rôle. Hence it is interesting to find that among the new records of ferns the proportions of those of South American (including Costa Rican), those of Mexican and northern Central American, and those of West Indian affinity are approximately 8 : 2 : 1. Of course this takes into consideration only the rarer ferns or those collected in newly visited regions, where they may indeed be common enough. Without brandishing any fancy formulas and computations, I merely observe that this ratio is about what I expect to find among the flowering plants when all records are in.

When one is introduced to a strange flora, he naturally expects *everything* to be new, and so it was with my first visits to Panama. All the ferns, I thought, must be different from those in Missouri; and so, being unfamiliar with the finer fern characters, I collected literally everything I saw with childish eagerness. That is why my face was so red when some of my old Missouri friends were sent back to me carefully labelled for my recognition: *Polypodium polypodioides, Cystopteris fragilis, Azolla caroliniana!* Goodness knows how many times I collected *Polypodium polypodioides,* half expecting each number to represent something different. But when my eyes were opened, I came to look forward to finding it perched high on the branch or crotch of some mossy old tree, just as it perches in southeastern Missouri.

Ferns have provided several memorable incidents to my collecting trips in Panama. Take for example the bracken, *Pteridium aquilinum,* represented by its tropical subspecies *caudatum,* which covers whole acres shoulder high in the highlands of Chiriquí Province. Here it appropriates any open, light soil that it can reach, and becomes a great pest in cultivated ground, just as the northern subspecies does in both Old and New England. Close to such a patch of bracken I have spent some of my happiest months of tropical collecting, quartered in a little shack poetically christened *Casita Alta,* perched about halfway up the side of the Volcán de Chiriquí. Our casita, for all the happy hours spent there, is scarcely a palace. It is constructed of rough-hewn boards, is about eight feet square, and has a door but no windows or floor. Viewing the hard ground upon which we were to sleep, upon our first visit, my companions and I were inspired to take great armfuls of the bracken to make ourselves fine, springy mattresses, and all went well and *very* comfortably that season.

Highland Forest, Valley of Upper Río Chiriquí Viejo, Panama.

The next year when we returned to *Casita Alta*, the bracken mattresses were still springy, if dried, and the first night we spread our sleeping bags upon them and comfortably reclined, reflecting upon auld lang syne and the economy of our upholstery. Before morning, however, first one of us, and then the others were awakened by a distressing itching sensation from head to foot. Muttered imprecations turned to shouts and finally to groans as we spent the rest of the night turning, twisting, and scratching.

In the morning the cause of our torment was clear: during our absence some furry denizen of the wild (perhaps a *tigre!*) had scratched a hole beneath the door and denned up in our fine bracken mattresses, apparently leaving multitudes of his sprightly passengers abed when he departed. And, friends, I am here to tell you that if there is anything worse than ants in your pants, it is fleas in your bed roll! Why did we need to sleep in bed rolls down so close to the Equator? Simply because it gets mighty chilly of a night in the Chiriquí mountains. I awakened one Fourth of July morning near the summit of the Volcán to see the sedges glistening with frost.

But the most remarkable of my "fern incidents" occurred during my second trip to Panama, on which I was accompanied by Dr. G. W. Martin, of the University of Iowa, and my student Russell J. Seibert. The three of us had the good fortune to induce Mr. Adrien M. Bouché, an amateur naturalist of the Canal Zone, to lead us to one of his particular stamping-grounds up a narrow valley directly behind the Volcán de Chiriquí. Since the place was a great distance from Panama City, and without any connecting roads, we chartered a plane to fly us and our baggage to an improvised landing field upon an ancient lava flow of the volcano. A mule train was supposed to meet us there on the Llanos del Volcán and carry our traps up to the camp site.

But when we landed at the *Llanos* no mules were in sight. So Bouché and Seibert set off to find them, leaving Martin and me guarding the baggage. Sitting there upon the *llanos*, we were delighted with the change of scenery and vegetation from the lowlands to the mountains, and opened up our presses to collect some of the little subalpines. Soon we became aware that one of the commonest plants was a tiny *Ophioglossum*, later described as *O. nudicaule* var. *vulcanicum* R. T. Clausen. It was a winsome little beggar, averaging scarcely a centimeter tall, and instantly won my affectionate interest. I started digging numerous specimens and was so absorbed in my task that I looked up with a start when a shadow fell across my recumbent shoulders. A mestizo cowboy was observing my occupation with sympathetic concern.

Trying to make the best of an awkward situation, I held up one of my adder's-tongues by thumb and forefinger, and inquired "Como se llama?"

"Nada!" ("Nothing!"), he replied, without batting an eye.

"No tiene nombre?" I persisted, secretly willing to agree that only a fool or a botanist would bestow a name upon such an insignificant plant.

"Sí, señor," came the firm reply, "Se llama 'nada'." Then, possibly sensing my disbelief, he tactfully withdrew.

Some time later Bouché and Seibert returned, but without the mules, and we all had to take to our shoulders our mountain of equipment and supplies. Trekking over the broad, empty *llano* and sweating under our impedimenta, we longed for the mules. But spurring us onward was a darkening sky, and the volcano gradually withdrew into the lowering clouds.

Suddenly Bouché spotted a figure approaching about

a half mile to one side, and on the chance of engaging a porter to carry at least some of our stuff we sat down to wait. When the chap arrived, we found him to be a second mestizo. Bouché immediately hailed him and offered him the sun, the moon, or a bright silver colón to help carry our things to Monte Lirio. But the chap was not interested. No, he had to find his cow and his pony before the falling of *mucho agua cerro*. Very respectfully he declined.

But—he had a present for *me!* And he held out in his fist a sizeable bouquet of *nadas*, carefully selected roots and all, exactly as I had been gathering them on the *llano* a couple of hours ago. Boy! You could have knocked me over with a *nada!* No, he wouldn't accept a handful of coins for the performance of this miracle, and grinning shyly he took off over the *llano* in search of his livestock.

To this day I am mystified by the speed with which the scientific "grapevine" functions on the Chiriquí *llanos*. And the *nadas:* Is that really their local name? Are they the "State Flower" of the *chiricanos?*

MISSOURI BOTANICAL GARDEN.

A New Record for Isoëtes melanopoda

J. W. MOORE AND R. M. TRYON, JR.

On a recent collecting trip in southwestern Minnesota an *Isoëtes* was discovered that proved to be *I. melanopoda* Gay & Dur. This represents a considerable extension of range for the species as now given in the most recent monograph[1] and in current manuals, and it seems worth while to report the locality, habitat, and associated species.

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[1] Pfeiffer, N. E. Monograph of the Isoetaceae. Ann. Mo. Bot. Gard. 9: 149, 150. 1922.

North of Luverne, Rock County (the extreme southwestern county) the Sioux quartzite is exposed at the surface and forms a sheer rock wall which faces south and southeast. The strata slope slightly downward to the north. A series of gently rounded hills, higher than the surrounding countryside, mark the southern part of this exposure. On the top of these hills, where pasturing has been light, a typical rocky prairie habitat is found. The rock, everywhere close to the surface, outcrops as flat exposures or as very low ridges. Several vernal pools occur between these outcrops.

Isoëtes was found in three of these pools, two of them on one hill, the other on a hill about a mile and a half to the northwest. At two of the pools *Isoëtes* grew at the border in wet prairie soil but not in water; at the other pool it grew in two to four inches of water. Some of the associated species will indicate what a mixture of aquatics, semiaquatics, and xerophytes grow in and around these wet-in-the-spring but dry-in-the-summer habitats: *Gratiola neglecta* Torr., *Elatine triandra* Schkuhr, both aquatic and terrestrial forms, *Myosurus minimus* L., *Limosella aquatica* L., *Eleocharis* spp., *Talinum parviflorum* Nutt., *Portulaca oleracea* L., *Opuntia Rafinesquii* Engelm., and another pteridophyte, infrequently encountered in Minnesota, *Marsilea vestita* Hook. & Grev.

The specimens (4 miles north-northwest of Luverne, Rock Co., Minnesota, July 8, 1945, *Moore & Tryon* 17582; 3 miles north of Luverne, *Moore & Tryon* 17557, 17559) are entirely characteristic of the species. The leaves are mostly 20 to 25 cm. long and the outer ones have a black base. The megaspores are 300 to 340 μ in diameter.

The records here given apparently represent the first report of the occurrence of this species of *Isoëtes* in Minnesota. *I. melanopoda* has been collected in the adjacent

portion of South Dakota and is listed by Over[2] as "rare in shallow water holes of the southern part." The nearest stations to the east and south are Clinton, Iowa, and Jackson Co., Missouri.

DEPARTMENT OF BOTANY,
UNIVERSITY OF MINNESOTA.

Two New Ferns from Colombia

WILLIAM R. MAXON and C. V. MORTON

In the course of their "Iter latino-Americanum" (1925–26) Dr. G. Woronow and Dr. S. Juzepczuk made a large and interesting collection of ferns, which was sent to the U. S. National Herbarium by the Jardin Botanique Principal, Leningrad, for identification. Recent study of this material discloses at least two new species from Colombia. These are described herewith. The first has been collected by others in a somewhat less well-developed condition; the second is of special interest as being the simplest member of a group of American species currently referred to *Diplazium*, subgenus *Anisogonium*.

Hemitelia Woronovii Maxon & Morton, sp. nov.

Caudex deest. Folia ut videtur ca. 2 m. longa; stipes 50 cm. longus, 1 cm. diam., olivaceus, glaber, basin versus dense paleaceus et subacute verrucosus, paleis lineari-attenuatis, usque ad 3.5 cm. longis et 3.5 mm. latis, minutissime ciliatis, pallido-spadiceis, anguste albido-marginatis, laxis, superioribus linearibus, tortuosis; lamina ovata, basi abrupte reducta, apice acuta, ca. 1.5 m. longa et 1 m. lata. bipinnata, rhachi olivacea, glabra, nuda; pinnae paucae, remotae, patentes, petiolulatae (2–3 cm.), basales ca. 18 cm. longa, solummodo pinnatifidae; pinnae mediales (maximae) 55 cm. longae et 30 cm. latae, oblongae, basi vix angustatae, apice abrupte acuminatae, pinnulae ca. 10-jugae, subaequales, inter se distantes, lineari-oblongae, longe acuminatae, usque ad 16 cm.

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[2] Over, W. H. Flora of South Dakota 13. 1932.

longae et 4 cm. latae, basales petiolulatae (2–3 mm.), apicales sessiles, grosse lobatae vel raro fere ad medium incisae, lobis majoribus utrinque ca. 10 vel 11, rotundo-deltoideis, sinu acuto 9–12 mm. latis, 6–9 mm. longis, subcoriaceis, marginibus arcte revolutis, leviter crenulatis vel partibus sterilibus serrulatis; venae 5–7-jugae, venula transverse conjunctae, areolis costalibus serie sola ita formatis elongato-triangularibus, sinum versus 2–4 radios simplices emittentibus; venae alterae simplices vel fertiles apicem versus breviter furcatae; sori plerumque 5- vel 6-jugi, inter se remotae, margine ca. 1 mm. distantes, sporangiis delapsis, receptaculis magnis globosis, indusiis semicirculis, brunneis, firmis, subintegris.

Type in the Komarov Botanical Institute of the U. S. S. R., Leningrad, collected at Peñas Blancas, Departamento de Antioquia, Colombia, April 25, 1926, by G. Woronow and S. Juzepczuk (No. 4549). No. 4548 with identical data is the same and duplicates of both are in the U. S. National Herbarium.

Hemitelia Woronovii resembles *H. petiolata* Hook., of eastern Panama and Colombia, and is closely related to that species only. The above description is drawn wholly from the two numbers cited, but almost certainly it must be emended to include two additional Colombian collections previously thought to represent a new species, viz. Norosi-Tiquisio Trail, Lands of Loba, Dept. Bolivar, alt. 150–600 meters, April–May, 1906, *H. M. Curran* 136 (3 sheets); vicinity of Barranca Bermeja, Magdalena Valley, between Sogamoso and Colorado Rivers, Dept. Santander, alt. 100–500 meters, Aug. 24, 1934, *Oscar Haught* 1337 (4 sheets). Concerning the last, Mr. Haught's field notes read as follows: "Probably the most common tree-fern of this part of the Magdalena Valley. Stem usually about 5–7 cm. in diameter, up to 5 m. high, not spiny; rarely branching, apparently by equal dichotomy. Does not usually produce fertile leaves until the stem has reached a height of 2 m. Leaves up to about 1.5 m. long by 0.4 m. wide, bipinnate, rather coriaceous, shining

above, dull below. Common on sandy soil, both on slopes and along streams." Both the Haught and the Curran specimens are much smaller than nos. 4548 and 4549 and probably are from younger plants; the pinnules range from crenate to merely undulate. The Haught specimen bears no scales, but *Curran* 136 (obviously the same) has the slender, long-attenuate, yellowish brown scales characteristic of *H. Woronovii*, in marked contrast to the broad, dark brown scales of *H. petiolata*. All four members agree in their short-petiolulate or even sessile pinnules, thus differing from *H. petiolata*. One more collection—a juvenile specimen—is apparently to be referred to *H. Woronovii:* Port Utria, Intendencia del Chocó, Colombia, Feb. 14, 1934, *W. R. Taylor* 1300.

Diplazium aberrans Maxon & Morton, sp. nov.

Rhizoma deest; stipites breves, usque ad 3 cm. longi, crassi, ca. 7 mm. diam., supra concava, brunnea, dense paleacea, paleis lanceolatis, acuminatis, basi subcordatis, usque ad 4 mm. longis et 2.5 mm. latis, cellulis elongatis, parietibus tenuibus, marginalibus castaneis, in dentibus bicornutis 0.3 mm. longis conjunctis; lamina simplex, oblanceolata, integra, margine leviter revoluta, 55–60 cm. longa, 11–13 cm. lata, apice obtusa, basi gradatim attenuata, basi ipsi cuneata, textura papyracea, pallide viridis, supra glabra, subtus in nervo mediali dense paleacea, paleis eis stipitis similibus sed brevioribus, latioribus, et longius attenuatis, venis basi parce paleaceis et cum mesophyllo laxe appresso-pilosis, pilis flaccidis, septatis, supra medium fertilis, zona marginali sterili ca. 1 cm. lata; venae patentes, ubique anastomsantes, areolis costalibus (saltem 60) anguste triangularibus, 15–20 mm. longis, basi 5–7 mm. latis, areolis secundariis 3- vel 4-seriatis, paracostalibus elongatis, linearibus, ad vel supra medium exeuntibus, alteris brevioribus, subhexagonis, marginalibus interdum apertis; sori numerosi in venis omnibus, diplazioidei, indusiis pallide brunneis, ca. 0.5 mm. latis, marginibus paullo irregularibus; annulus ca. 13-cellularis; sporae bilaterales, pallide flavae,

35–40 μ longae, ca. 25 μ diam., perspicue alatae, alis dimidiam partem latitudinis excedentibus.

Type in the Komarov Botanical Institute of the U.S.S.R., Leningrad, collected at Sucre, Territorio de Caquetá, Colombia, July 10, 1926, by G. Woronow and S. Juzepczuk (No. 5877).

From other members of the subgenus *Anisogonium* the present species is distinguished at once by its simple, entire, oblanceolate blades. It is characterized also by the horizontally spreading veins, the narrowly triangular costal areoles, and especially by the abundant persistent scales on the lower side of the midrib. These scales, and also the scales of the stipe, are peculiar in their structure. The marginal cells are lunate. The projecting part of the cell forms with the adjacent cell a two-horned tooth. This peculiar type of toothing is found in other species of the subgenus *Anisogonium*, being in fact the character suggesting the name *Diplazium ceratolepis* Donn. Smith, and is illustrated in Kunze's figure of *Diplazium pinnatifidum* (Anal. Pterid. *pl. 16.* 1837). It does not appear to be known in the subgenus *Eudiplazium.*

SMITHSONIAN INSTITUTION.

Shorter Note

A VARIETY OF ATHYRIUM DECURTATUM FROM ARGENTINA.—In 1931 Dr. Arturo Burkart sent me specimens of an *Athyrium* from river-bank woods along the estuary of the Río de la Plata which I tentatively determined as an undescribed variety of *A. decurtatum.* However, since the variety depended largely on an often unstable character of pubescence and the material at hand was scanty, I deferred publication until more information should be available. Collections which have gradually accumulated since indicate that the plant in question is not a casual mutant but is well established in a restricted area. It is accordingly proposed as:

ATHYRIUM DECURTATUM (Kze.) Presl, var. **platense**, var. nov., a varietate typica differt lamina indusiisque minute pallideque glandulosis aliter glabris.—ARGENTINA, PROV. BUENOS AIRES: monte a orillas del Río de la Plata (cerca de La Plata), Isla de Santiago, Feb., 1931, *Burkart 3681*, TYPE in herb. Gray; monte ribereño del Río de la Plata, Conchitas, April, 1927, *Burkart 1309;* Carabelas, Delta del Paraná, Jan., 1931, *Perez Moreau 589, 3998, Burkart 4327.*

In typical *A. decurtatum* both surfaces of the lamina are pubescent with short hairs and the indusia are similarly pubescent on the back and ciliate. Baker's plate 45, fig. 1, in vol. 1, pt. 2 of the Flora Brasiliensis, though somewhat conventionalized, shows these details with essential accuracy. The indusia may show the large, sessile, reddish glands which occur on the leaf-surface in both varieties, but they lack the fine, pale glandularity of var. *platense.*

Specimens and literature at hand indicate that typical *A. decurtatum* ranges from southeastern Minas Geraes in Brazil to the northern part of Buenos Aires Province and west through Paraguay and the northern provinces of Argentina to Tucumán. Apparently it is nowhere common. As above noted, var. *platense* is known to me to occur only in the region about the estuary of the Río de la Plata.

It may be added, by way of foot-note, that the species was originally described, as *Asplenium decurtatum,* in Link's "Filicum Species in Horto. . . . Berolinensi cultae," 1841, without indication of authorship. It has therefore been sometimes credited to Link; but Gustav Kunze, in Linnaea **23**: 233 (1850) and again in the same journal (**24**: 268), referred to it as his. There seems no reason to disbelieve him; the author-citation as above given is generally accepted as correct.—C. A. WEATHERBY, *Gray Herbarium.*

American Fern Society

THE COMING BOSTON MEETING.—In connection with the scheduled Christmas meetings of the American Association at Boston, December 26–31, 1946, a meeting of the American Fern Society is planned, the exact details of time and place to be announced. The success of this meeting will depend, as always, upon the members' participation in the program. Reports on life history studies, field ecology, notable range extensions, as well as systematic recensions, will be welcomed. Titles of papers to be presented, along with information as to need for a projector and/or screen, should be sent to me by October 16th, to be certain of inclusion in the AAAS printed program.—J. EWAN, *Smithsonian Institution.*

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A QUARTERLY DEVOTED TO FERNS

Published by the

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EDITORS

WILLIAM R. MAXON

R. C. BENEDICT C. V. MORTON

IRA L. WIGGINS

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American Fern Journal

VOL. 36 OCTOBER–DECEMBER, 1946 NO. 4

A Check-list of the Ferns of Arizona

WALTER S. PHILLIPS

At the time that Blake (1) published his list of state and local fern floras of the United States there were only two definite references to Arizona. One by Ferriss (8) on the ferns of Cochise County and another by Little (11) on the ferns of the Sierra Ancha in Gila County. Since then Wherry (30) in writing of the discovery of *Asplenium adiantum-nigrum* in Arizona has added a short list of ferns from Elden Mountain in Coconino County. The two floras of Arizona mentioned by Blake as being "in press" have been published.

Sister Teresita Kittell, in Tidestrom & Kittell's "Flora of Arizona and New Mexico" (24), recognizes more species as occurring in Arizona than are here listed. In her work only the general ranges of the species are given and some of the ranges taken from previous literature citations perpetuate alleged records not substantiated by actual specimens. Maxon in his treatment of the pteridophytes in Kearney & Peebles' "Flowering Plants and Ferns of Arizona" (10) is more specific in the ranges of species, but he cites collections only for the rarer species. Maxon's work was largely prepared from material in the United States National Herbarium and from collections of the two authors and their fellow workers. The material in other herbaria was not examined extensively. For a review of these floras see Morton (19 and 20).

The present check-list is based almost entirely on specimens found in various herbaria in Arizona. It will fill out many of the ranges as given by Maxon.

[Volume 36, No. 3, of the JOURNAL, pp. 65–96, was issued September 16, 1946.]

MOHAVE
COCONINO
NAVAJO
APACHE
YAVAPAI
MARICOPA
GILA
GRAHAM
YUMA
PINAL
PIMA
COCHISE
GREENLEE
SANTA CRUZ
KINGMAN
FLAGSTAFF
PRESCOTT
HOLBROOK
PHOENIX
TUCSON
SAFFORD
AJO
YUMA
DOUGLAS
COLORADO RIVER
LITTLE COLORADO RIVER
GILA RIVER
SALT RIVER
SAN PEDRO RIVER
SANTA CRUZ RIVER
MOGOLLON RIM
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ARIZONA

The accompanying map gives the main collecting grounds as found in this state. They are mainly mountain ranges. Some ranges cross county boundaries and actual placing of collections by counties becomes difficult.

INDEX TO LOCALITIES SHOWN ON MAP

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Aqua Dulce Mountains, Pima County 70
Aquarius Cliffs, Mohave and Yavapai Counties 22
Atascosa Mountains, Santa Cruz County 90
Aubrey Cliffs, Coconino County 13
Baboquivari Mountains, Pima County (Quinlan and Coyote Mts. at north end) 83
Betatakin Canyon, Navajo County (a side-canyon of Sagie Canyon) 4
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Bradshaw Mountains, Yavapai County 26
Buckskin Mountains, Yuma County 29
Cabeza Prieta Mountains, Yuma County (Copper Mountains at north end) 52
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Harqua Halla Mountains, Yuma and Maricopa Counties 32
Hopi Buttes, Navajo County 17
Hopi Mesa, Navajo County 15
Huachuca Mountains, Cochise County 87
Hualpai Mountains, Mohave County 21

There are five main herbaria in the state, located at the Grand Canyon National Park, the Museum of Northern Arizona, the Flagstaff State Teachers College, the University of Arizona, and the Sacaton Herbarium, which houses the specimens of Kearney and his co-workers collected in working up the state flora. Maxon has annotated most of the material in this herbarium. In addition to the above, the Chiricahua National Monument has an herbarium that contains a few sheets of ferns from the Chiricahua region. The largest collection in the state is at the University of Arizona and contains about 800 sheets of pteridophytes from this state. This collection also contains the recently acquired Forrest Shreve Herbarium, which has many sheets from southern Arizona and northern Mexico.

Kaibab Plateau, Coconino County	9
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Kofa Mountains, Yuma County	42
Lukachukai Mountains, Apache County	6
Maricopa Mountains, Maricopa County	45
Mazatzal Mountains, Gila and Maricopa Counties	34
Mingus Mountains, Yavapai County	24
Mogollon Rim, the southern escarpment of the Colorado Plateau, Coconino, Navajo, and Apache Counties	
Mohawk Mountains, Yuma County	53
Mule Mountains, Cochise County	86
Navajo Mountain, Coconino County (mostly in Utah)	3
Oak Creek Canyon, Coconino and Yavapai Counties	25
Oro Blanco Mountains, Santa Cruz County	89
Pajarito Mountains; same as Oro Blanco Mountains	
Paria Plateau, Coconino County	2
Patagonia Mountains, Santa Cruz County	88
Peloncillo Mountains, Greenlee, Graham, and Cochise Counties	61
Picacho Mountains, Pinal County	57
Pinaleno Mountains, Graham County (Graham Peak is part of this range)	60
Pinal Mountains, Gila County	38
Plomosa Mountains, Yuma County	31
Puerto Blanco Mountains, Pima County	71
Quijotoa Mountains, Pima County	73
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Roskruge Mountains, Pima County	75
Sacaton Mountains, Pinal County	50
Sagie Canyon, Navajo County	4
Sand Tank Mountains, Maricopa County	55

The genera and species are arranged in alphabetical order, using the nomenclature of Broun (2) except in a few specifically mentioned cases. Under each species the specimens are arranged by counties and by geologic units (usually mountain ranges). When a letter follows the citations it refers to the herbarium in which the sheet is found: Sacaton Herbarium (S), Museum of Northern Arizona (N), Flagstaff State Teachers College (F), Grand Canyon National Park (G), and Chiricahua National Monument (C). The unlettered specimens are at the University of Arizona.

A list of doubtful or excluded species is given at the end of the paper, as well as a bibliography.

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Tucson Mountains, Pima County 76
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Vulture Mountains, Maricopa County 33
Weaver Mountains, Yavapai County 27
Whetstone Mountains, Cochise and Pima Counties 81
White Mountains, Apache County 36
White Tank Mountains, Maricopa County 40
Winchester Mountains, Cochise County 63

ADIANTUM CAPILLUS-VENERIS L.

Throughout the state on moist cliffs and banks, mostly on limestone or where the water is charged with lime, 1,600–6,800 feet. COCHISE: Huachuca Mts., Tanner Canyon, *Goodding* 825. COCONINO:[1] Grand Canyon National Park, Seep Spring, *Hawbecker* (N). Havasu Canyon, *Whiting* (N). Oak Creek Canyon, *Wetherill* (N). Tuba City, *Harrison & King* 8711 (S). GILA: Sierra Ancha, *Little* 4310. GREENLEE: San Francisco River, Pigeon Creek Trail, *Goodding* 1285. NAVAJO: Sagie Canyon, *Whitehead*. Betatakin Canyon, *Wetherill* 181 (N). PINAL: Canada del Oro, *Spruance*. Galiuro Mts., *Darrow*. SANTA CRUZ: Oro Blanco Mts., Sycamore Canyon, *Darrow*. Santa Rita Mts., Madera Canyon, *Loomis & King* 2923 (S); *Peebles et al.* 4529 (S); *Thornber*; *Phillips* 2862.

ADIANTUM CAPILLUS-VENERIS forma ELONGATUM Lemmon.

Described by Lemmon as a very large form reaching a length of 8–20 feet, from Sanoita [Sonoita] Valley, in what is now Santa Cruz County. Evidently this locality is now known as Monkey Springs on the Rail-X Ranch (SW ¼, Sec. 3, T21S, R16E). The spring and the old calcareous deposits are present as Lemmon described them, but the water from the spring has been diverted to a reservoir and the old seep banks are dry, with only a few patches of the fern remaining. Where this fern still occurs it is very dwarfed due to grazing except for one or two places that are out of reach of the cattle. I have collected a few fronds up to 24 inches long (*Phillips* 2873), but they show no more variation than usual and collections from other localities are as large. The "8–20 feet" described by Lemmon referred, I am sure, to the whole bank and not to the individual fronds.

ADIANTUM PEDATUM var. ALEUTICUM Rupr.

In moist shaded areas. COCHISE:[2] Huachuca Mts., *Goodding* 1456. COCONINO: Oak Creek Canyon, locally abundant, *Deaver*. Dr. Maxon has annotated both these sheets and agrees that they are var. *aleuticum*.

ASPLENIUM ADIANTUM-NIGRUM L.

In crevices of cliffs of dacite rock. COCONINO: Elden Mt., 7,500

---

[1] Clover and Jotter (5) list collections from Deer Creek Falls, Vasey's Paradise, and Marble Canyon in the Colorado River Canyon and its tributaries. They list also collections from the Colorado River about Lake Mead, Mohave County.

[2] Ferriss (8) lists the Chiricahua Mts. also.

ft., *Whiting & Bradey* (N); *Lefebure* 868. Maxon (10) lists *Whitehead* 2051 also. For an account of this fern in Arizona see Wherry (30).

ASPLENIUM EXIGUUM Bedd.

Extremely local and limited to two mountain ranges along the southern border, on moist north-facing slopes at about 4,000 ft. COCHISE: Maxon (10) cites Lemmon in 1882 from the Huachuca Mts. SANTA CRUZ: Oro Blanco Mts., Sycamore Canyon, *Goodding* (S); *Darrow* 2047. Broun (2) lists this as *A. glenniei* Baker and omits the name *A. exiguum*, which is the proper designation for this fern according to Hope (9) and Maxon (12).

ASPLENIUM MONANTHES L.

On moist, shaded cliffs, and rocky slopes at 8,000 ft. COCHISE: Huachuca Mts., Miller Canyon, *Goodding* 100; without locality, *Goodding* 1295, 1314.

ASPLENIUM PALMERI Maxon.

At the base of cliffs and under large boulders in moist situations at 4,000 to 5,000 ft. COCHISE: Mule Mts., *Goodding* 66.[3] PIMA: Baboquivari Mts., *Harrison* 3531 (S); *Peebles & Harrison* 3955 (S). SANTA CRUZ: Tumacacori Mts., Box Canyon, *Shreve*. Oro Blanco Mts., Sycamore Canyon, *Benson* 10956.

ASPLENIUM RESILIENS Kunze.

At scattered stations in various mountain ranges in deep canyons and shaded rocky places, 2,000 to 7,000 ft.; often growing at higher altitudes with *A. trichomanes*. COCHISE: Chiricahua Mts.: *Loomis & Peebles* 5409 (S); Echo Canyon, *Clark* 8440; Rucker Canyon, *Phillips & Darrow* 2778; *Phillips* 2860. Huachuca Mts.: *Goodding* 1295; Carr Canyon, *Phillips et al.* 2560; Garden Canyon, *Peebles et al.* 3419 (S); Ramsey Canyon, *Goodding* 740, 771; *Darrow* 2591. GILA: Sierra Ancha, Parker Creek, *Little* 4189. PIMA: Baboquivari Mts., *Gould et al.* 2745. Maxon (10) lists Coconino, Greenlee, and Yuma Counties also.

ASPLENIUM SEPTENTRIONALE (L.) Hoffm.

In crevices of cliffs of igneous rock, 8,000 to 9,000 ft. The station on the Mogollon Rim consists of thousands of plants scattered over a north-facing cliff in the Western Yellow Pine forest. COCONINO: Mogollon Rim, *Phillips* 2852. PIMA: Santa Catalina Mts., Wilderness of Rocks, *Phillips* 2463; *Phillips &*

[3] Maxon (10) cites *Goodding* 976 from the same locality.

Darrow 2580. Maxon (10) cites *MacDougal* 68 from the San Francisco Mts., Coconino Co.

ASPLENIUM TRICHOMANES L.

On moist, shaded cliffs and under ledges along streams, 6,000 to 9,000 ft. COCHISE: Chiricahua Mts.: *Loomis & Peebles* 5414 (S); Rucker Canyon, *Phillips & Darrow* 2768, 2779, 2783. COCONINO: Elden Mt., *Whiting & Bradey*. GRAHAM: Pinaleno Mts.: Marijilda Canyon, *Phillips et al.* 2481; Skull Valley, *Phillips et al.* 2508. PIMA: Santa Catalina Mts.: Mt. Lemmon, *Carter;* Marshall Gulch, *Thornber & Lloyd* 4193; *Brown; Phillips* 2320; Bear Wallow, *Graham;* Soldier Camp, *Peebles* 4075 (S); *Phillips* 2361. Rincon Mts., Manning Camp, *Blumer* 3464.

ATHYRIUM FILIX-FEMINA var. CALIFORNICUM Butters.

Rich, moist soil along streams and about springs, 7,000 to 9,000 ft. APACHE: White Mts.: Bonita Creek, *Goodding* 1217; Black River, *Goodding* 557; Hannagan Meadows, *Phillips* 2811; Big Lake to Alpine, *Phillips* 2832. COCHISE:[4] Chiricahua Mts., Cold Spring, *Blumer* 1650. GRAHAM: Pinaleno Mts.: *Thornber & Shreve* 7920, 7921, 7922; Riggs Flat, *Shreve* 5256; Swift Trail, *Moeller* 196; Moonshine Canyon, *Phillips et al.* 2501, 2502. PIMA: Santa Catalina Mts.: Mt. Lemmon, *Harrison et al.* 2515 (S); *Phillips* 2400; Marshall Gulch, *Shreve* 5410; *Thornber* 7316; Sabino Canyon, *Thornber* 7313; *Phillips* 2375. This fern exhibits great variation in the state, but all specimens seem to be referable to var. *californicum*.

AZOLLA FILICULOIDES Lam.

Rare and sporadic in Arizona. Formerly abundant in irrigation ditches at Fort Lowell (near Tucson), but not collected recently, 2,500 to 4,000 ft. PIMA: Rillito, irrigation ditches, *Thornber* in 1903; *Thornber* 2681. SANTA CRUZ: Crittenden, *Thornber* 2891. Maxon (10) cites *A. caroliniana* Willd. from Fort Lowell (*Rothrock* 714). This collection is from the same locality as Thornber's specimens from Rillito, one of which Svenson (22) cites.

BOMMERIA HISPIDA (Mett.) Underw.

Among loose boulders and at bases of cliffs in rich humus, 4,000 to 6,000 ft.; common in the oak-woodland and chaparral of southeastern Arizona. COCHISE: Chiricahua Mts.: Rucker Canyon,

[4] Maxon (10) lists the Huachuca Mts. also.

Phillips et al. 2533; White Tail Canyon, *Clark* 8343; Cave Creek, *Phillips et al.* 2527. Bowie, *Jones* 4254. Huachuca Mts.: Carr Canyon, *Phillips et al.* 2543; Ramsey Canyon, *Goodding* 772; Palmerlee, *Goodding* 395; Fort Huachuca, *Phillips* 2795. Mule Mts., *Goodding* 996. GILA: Sierra Ancha, Parker Creek, *Little* 4211. GRAHAM: Pinaleno Mts., Swift Trail, *Peebles* 14524 (S). PIMA: Baboquivari Mts., *Peebles* 601 (S). Coyote Mts., *Phillips* 2608. Rincon Mts.: Happy Valley, *Phillips* 2867; Mountain Spring Canyon, *Gould* 3034. Santa Catalina Mts.: Soldier Canyon, *Shreve* 5114; Castle Rock, *Griffiths* 2126. Santa Rita Mts., Florida Canyon, *Thornber*. PINAL: Galiuro Mts., Holy Joe Peak, *Darrow*. SANTA CRUZ: Patagonia Mts., *Peebles et al.* 5587 (S). Santa Rita Mts., Madera Canyon, *Loomis et al.* 1347 (S). Maxon (10) lists Yavapai Co. also.

BOTRYCHIUM LANCEOLATUM (S. G. Gmel.) Ångstr.

In subalpine meadows: COCONINO: San Francisco Mts., Inner Basin, 11,000 ft., *Little* 4740. Maxon (10) cites *Little* 4679 also.

BOTRYCHIUM LUNARIA (L.) Swartz.

In subalpine spruce-fir forests. COCONINO: San Francisco Mts.: Inner Basin, 11,000 ft., *Little* 2741; Fremont Pass, *Kearney & Peebles* 12123 (S). Maxon (10) cites *Collom* 890 also.

BOTRYCHIUM MULTIFIDUM var. COULTERI (Underw.) Broun.

APACHE: White Mts., in wet meadows, Diamond Creek Beaver Dams, 8,000 ft., *Goodding & Schroeder* 340–41. The sheet in the Sacaton Herbarium has the same locality data but the number 338–41.

BOTRYCHIUM VIRGINIANUM (L.) Swartz.

A single collection by Pringle in 1884 from the Santa Rita Mts. (Pima or Santa Cruz Co.) is deposited in the Gray Herbarium. Recent search has failed to relocate this station, which was probably a spring or waterhole which has been destroyed by over-grazing.

CETERACH DALHOUSIAE (Hook.) C. Chr.

Rare and extremely local in the southeastern part of the state; in moist soil under the edges of large boulders and overhanging ledges of cliffs, 4,000 to 6,000 ft.; usually well hidden and difficult to find. COCHISE:[5] Mule Mts., Asplenium Canyon, *Goodding* 67, 969. PIMA: Baboquivari Mts., Baboquivari Canyon, *Gilman* (S); *Peebles & Harrison* 3954 (S); *Harrison & Swift* 7733 (S).

[5] Clute (6) cites this species as collected by Ferriss in the Huachuca Mts., between Brown and Tanner Canyons.

CHEILANTHES ALABAMENSIS (Buckl.) Kunze.

Shaded north slopes of limestone hills in oak-woodland, in crevices of rocks at 5,000 ft.; growing with *Pellaea intermedia*. SANTA CRUZ: Canello Hills, near Monkey Springs, *Darrow* 2311; *Phillips & Reynolds* 2871. Maxon (10) cites *Lemmon* in 1882 from Conservatory [Ramsey] Canyon, in the Huachuca Mts.

CHEILANTHES CASTANEA Maxon.

Common in rocky, shaded canyon sides in southeastern Arizona, 4,000 to 8,000 ft.; see note under *C. eatonii*. COCHISE: Bowie, *Jones* 4324. Chiricahua Mts.: Barfoot Park, *Blumer* 1868; Onion Pass, *Phillips et al.* 2523; Rigg Canyon, *Blumer* 1943; Rucker Canyon, *Phillips & Darrow* 2767, 2775; White Tail Canyon, *Clark* 8344. Douglas, *Darrow* 2565. Huachuca Mts.: *Goodding* 1301: Carr Canyon, *Phillips et al.* 2550; Miller Canyon, *Darrow* 2554; *Phillips* 2801; Garden Canyon, *Peebles et al.* 3403 (S), 3439 (S); Ramsey Canyon, *Goodding* 765. COCONINO: Havasu Canyon, *Whiting* (G, N). PIMA: Baboquivari Mts., South Canyon, *Peebles et al.* 3830 (S); *Harrison & Swift* 7726 (S). Rincon Mts., Happy Valley, *Phillips & Pultz* 2726. Santa Catalina Mts., Peppersauce Canyon, *Phillips* 2316. Santa Rita Mts., Florida Canyon, *Thornber*. SANTA CRUZ: Santa Rita Mts.: Madera Canyon, *Kearney et al.* 10501 (S); *Shreve* 5175; Onyx Cave, *Kimber;* Oro Blanco Mts., Sycamore Canyon, *Benson* 10957; *Kearney & Peebles* 14876 (S).

CHEILANTHES COVILLEI Maxon.

Rare and scattered in south-central Arizona, usually on igneous rocks on dry slopes, 2,000 to 5,000 ft. GILA: Pine Creek, *Peebles et al.* 5225 (S). MARICOPA: Mormon Flats, *Loomis & Peebles* 1044 (S); *Thackery* 1005 (S). Sierra Estrella, *Kearney et al.* 7752 (S); *Darrow*. MOHAVE: Oatman-Kingman Rd., *Kearney et al.* 7608 (S). PINAL: Superstition Mts., *Peebles et al.* 3717 (S): *Peebles & Fulton* 6382 (S), 6384.

CHEILANTHES EATONII Baker.

Dry rocky canyons and slopes, often growing in the same colony with *C. castanea*, 4,000 to 7,000 ft. COCHISE: Chiricahua Mts.: Cave Creek, *Phillips et al.* 2531; Hand's Trail, *Blumer* 1529; Pedestal Rock, *Blumer* 1513. Fort Bowie, *Blumer* 1504. Dos Cabezas Mts., *Phillips et al.* 2516, 2520, 2521. Mule Mts., *Goodding* 1395. GILA: Sierra Ancha, Parker Creek, *Little* 4217. GRAHAM: Pinaleno Mts.: *Thornber & Shreve* 7798; Frye Canyon, *Shreve*, 4363. PIMA: Santa Catalina Mts., Pima Canyon, *Thornber & Brown*. Rincon Mts., Happy Valley, *Phillips & Pultz* 2756a, 2757a.

PINAL: Summit of Superior-Miami Highway, *Peebles* 5283 (S). Maxon (10) lists Navajo, Coconino, and Santa Cruz Counties also. Sometimes it is hard to distinguish between *C. castanea* and *C. eatonii*. Shade and sun forms vary greatly, and further work is needed to set these species apart properly.

CHEILANTHES FEEI Moore.

In crevices of dry cliffs or rocky slopes, 2,000 to 7,000 ft.: common on limestone, but often on sandstone also. COCHISE: Chiricahua Mts., Paradise Falls, *Blumer* 1332. Dos Cabezas Mts., *Phillips et al.* 2519. Douglas, *Darrow* 2564, 2567. Huachuca Mts.: Ramsey Canyon, *Goodding* 769; Tanner Canyon, *Lemmon* (S). COCONINO: Elden Mt., *Whiting & Bradey* (N). Grand Canyon National Park: South Rim, *Whiting* (N); Bright Angel Trail, *Thornber* 8235; Hermit Trail, *Collom* 1124; Havasu Canyon, *Peebles* 15010 (S); *Whiting* (N); Rowe's Well, *Collom* (G); Walnut Canyon, *Whiting* (N). MOHAVE: Meriwitica Canyon, *Whiting* (S). Betatakin Canyon, *Wetherill* 481 (N). Sagie Canyon, *Whitehead*. NAVAJO: Navajo National Monument, *Wetherill* (N). PIMA: Santa Catalina Mts., Butterfly Peak, *Phillips* 2434.

CHEILANTHES FENDLERI Hook.

In crevices of cliffs of igneous rock and on rocky slopes in shady situations, 4,000 to 9,500 ft. This species reaches the highest altitude of any of the various *Cheilanthes* species. COCHISE: Bowie, *Jones* 4282. Chiricahua Mts.: Balanced Rock, *Clark* 8443; Big Immigrant Canyon, *Blumer* 1505; Cave Creek, *Loomis & Peebles* 5398 (S); *Harrison et al.* 6202 (S); Rucker Canyon, *Phillips & Darrow* 2770; Tex Canyon, *Phillips et al.* 2536. Huachuca Mts.: *Peebles et al.* 3441 (S); *Goodding* 1317; Carr Canyon, *Phillips et al.* 2555; Miller Canyon, *Goodding* 407. Mule Mts., *Goodding* 468. GILA: Mazatzal Mts.: Hell Canyon, *Harrison et al.* 7832 (S); *Shreve*. Pinal Mts., *Phillips* 2743. GRAHAM: Galiuro Mts., High Creek, *Pultz & Phillips* 1852. Pinaleno Mts.: Lookout at 9,357 ft., *Phillips et al.* 2505; Columbine Trail, *Thornber & Shreve* 7800; Noon Creek, *Peebles* 14532 (S). PIMA: Baboquivari Mts., *Peebles* 541 (S). Rincon Mts., Happy Valley, *Phillips & Pultz* 2728, 2754. Santa Catalina Mts.: Butterfly Peak Trail, *Phillips* 2312, 2385; Cherry Creek, *Shreve* 5113; Wilderness of Rocks, *Phillips* 2464; Sabino Canyon, *Livingston & Thornber*; Soldier Canyon, *Benson* 11478. Santa Rita Mts., Florida Canyon. *Thornber & Griffiths* 179; *Thornber* 324. PINAL: Summit of Superior-Miami Highway, *Kearney & Peebles* 9246 (S). Sierra

Estrella, *Thornber*. SANTA CRUZ: Patagonia Mts., Flux Canyon, *Peebles* 10609 (S). Santa Rita Mts., Madera Canyon, *Kimber; Phillips* 2291. YAVAPAI: Prescott, *Thornber* 8666. Maxon (10) lists Coconino and Mohave Counties also.

CHEILANTHES LENDIGERA (Cav.) Swartz.

Rare in Arizona but locally very abundant; in moist shaded ravines and canyons of igneous rock it may form extensive colonies in three of the mountain ranges of southeastern Arizona, 5,000 to 6,000 ft. COCHISE: Chiricahua Mts.: *Peebles & Loomis* 5412 (S); Rucker Canyon, *Phillips & Darrow* 2769. Huachuca Mts.: *Goodding* 1313; Ramsey Canyon, *Peebles et al.* 3500 (S); *Goodding* 762; *Lemmon; Darrow* 2593. PIMA: Rincon Mts., Happy Valley, *Phillips & Pultz* 2730, 2750, 2751, 2752. SANTA CRUZ: Oro Blanco Mts., Sycamore Canyon, near Ruby, *Darrow & Haskell* 2044.

CHEILANTHES LINDHEIMERI Hook.

Very common in the foothills of all mountain ranges in southeastern Arizona. A favorite habitat is around the bases of large boulders in the accumulated humus which holds a little extra moisture, 2,000 to 8,000 ft. COCHISE: Apache Pass, *Lemmon*. Bowie, *Jones* 4256. Chiricahua Mts.: Cave Creek, *Phillips et al.* 2532; Morse Canyon, *Blumer* 1519; Ryolite Canyon, *Clark* 8231 (C). Dragoon Mts., *Griffiths* 1875. Huachuca Mts.: Carr Canyon, *Phillips et al.* 2547; Palmerlee, *Goodding* 394; Ramsey Canyon, *Shreve* 3044. Mule Mts., *Goodding* 2513. GILA: Sierra Ancha, Parker Creek, *Little* 4200. GRAHAM: Pinaleno Mts.: Swift Trail, *Peebles* 14532a (S); Turkey Flats, *Kearney & Peebles* 14107 (S). PIMA: Ajo Mts., Alamo Canyon, *Tinkham*. Baboquivari Mts.: Baboquivari Peak, *Gould et al.* 2693; Baboquivari Canyon, *Peebles* 605 (S); Fresnal Canyon, *Loomis* 923 (S); Toros Canyon, *Peebles et al.* 3775. Coyote Mts., *Phillips* 2592. Puerto Blanco Mts., Dripping Springs, *Gould et al.* 2440. Santa Catalina Mts.: Campbell Ave. foothills, *Phillips* 2586; Pantatoe Canyon, *Phillips* 2277; Sabino Canyon, *Thornber* 318, 5229, 8168. Soldier Canyon, *Phillips & Pultz* 2475. Santa Rita Mts., Florida Canyon, *Thornber*. Sierrita Mts., *Spalding*. Tucson Mts., *Swingle* S74. PINAL: Superstition Mts., *Peebles & Fulton* 6383 (S). Oracle, *Spruance*. SANTA CRUZ: Patagonia Mts.: *Peebles et al.* 5585 (S); *Kearney & Peebles* 14819 (S); *Phillips* 2792; Flux Canyon, *Benson* 11508. Oro Blanco Mts., near Ruby, *Kearney & Peebles* 13782 (S). Tumacacori Mts., Peck Canyon, *Phillips* 2797. Maxon (10) lists Maricopa County also.

(*To be continued*)

Long-lived Fern Prothallia

R. L. WALP and G. R. PROCTOR

There is considerable evidence that fern prothallia are like many other plants in that they will extend their life-span if kept from reproducing. Most fern gametophytes produce sporophytes within a few months after spore germination, and then die. In 1927, Mottier (5) reported keeping alive the prothallia of *Osmunda Claytoniana* L. and *Pteretis nodulosa* (Michx.) Nieuwl. for 3½ and 4 years, respectively. He concluded from his study that the continuation shoots of prothallia are able to grow indefinitely. Further evidence at Marietta College substantiates this finding.

In the fall of 1938 several kinds of fern spores (*Adiantum pedatum* L., *Asplenium platyneuron* (L.) Oakes, *Camptosorus rhizophyllus* (L.) Link, and *Polystichum acrostichoides* (Michx.) Schott) were sown on a sterile inverted flower pot filled with *Sphagnum*. The pot had been placed in a deep culture dish containing Knop's nutrient solution; over it a glass bell-jar was placed after the spores were sown. During the next few months, hundreds of prothallia appeared, forming a rather dense covering over most of the pot. At one time, in the early stages, the culture was invaded by molds; these fungi were eliminated by spraying the pot lightly with a fresh weak solution of potassium permanganate, and by occasionally adding a few small grains of the same chemical to the nutrient solution. Except for this spraying, the culture received all its moisture by capillarity from below. The bell-jar served not only to keep the atmosphere humid, but also to keep out air-borne contamination. Because of overcrowding, watering by subirrigation, and perhaps the application of potassium permanganate solution, very few gametophytes ever produced sporophytes.

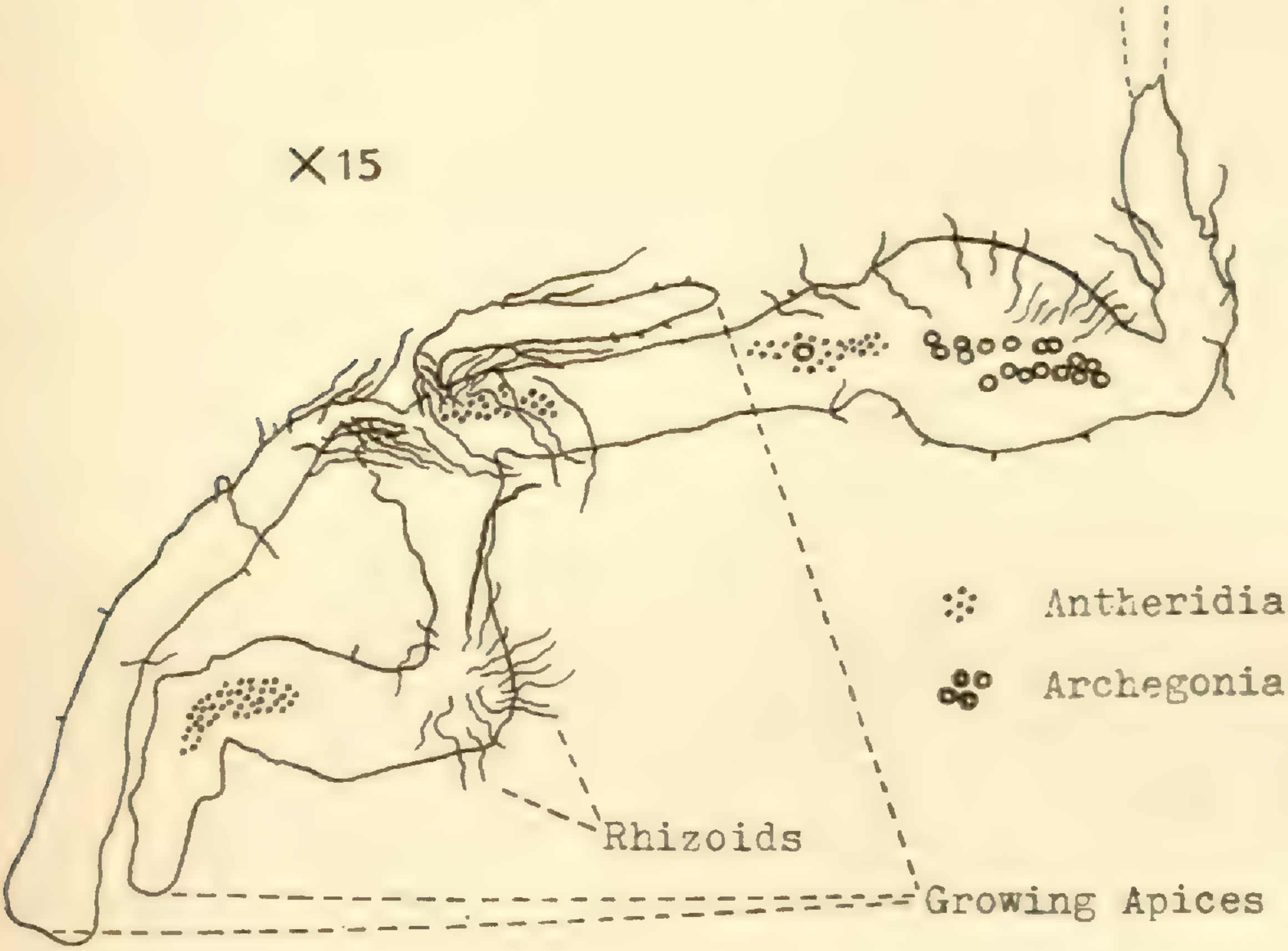
In 1938 and 1939, nutrient solution was supplied whenever moisture was needed, but thereafter only tap water has been used. The culture has been kept in a north window, at ordinary room temperatures, and rotated periodically. It is now in its eighth year of growth.

It might be well to make clear that this was not originally intended to be an experiment in prothallium longevity, but was set up merely as a demonstration of fern gametophytes for freshman biology students.

In its natural habitat a fern gametophyte usually withers away soon after producing a sporophyte. The reason for this is not definitely known. It may be due to a partial parasitism of the young, rapidly growing sporophyte, or perhaps it can be attributed to some growth-inhibiting hormone. The situation is poorly understood, and offers a possibility for fruitful study.

If no zygote is formed on the gametophyte, the latter may continue vegetative growth, either from the apical growing point or, also, by lateral proliferation. Adventitious branching of prothallia has been reported by many writers, though apparently this condition does not occur regularly (except in *Vittaria*), but rather as a result of unusual growth conditions, such as weak light [Klebs (4)], starvation [Atkinson (2)], or submersion in water [Black (3)]. Elizabeth Wuist (6), however, was able to induce both dichotomous and monopodial branching of the young prothallia of 15 species of Polypodiaceae, including *Asplenium platyneuron* and *Camptosorus rhizophyllus*, grown under various conditions. No branching occurred in nutrient solutions containing all necessary elements, and she postulates poor nutrition as a favorable stimulus for branching. Mottier (5) describes dichotomous branching as apparently a natural occurrence in old age of *Osmunda Claytoniana* and *Pteretis nodulosa* gametophytes. More recently,

Albaum (1) has shown that adventitious prothallia may be produced laterally if the growing apex of a prothallium is removed. At Marietta lateral proliferation has occurred spontaneously on the less crowded plants.



Prothallium with sex organs

At present, the top of the $7\frac{1}{2}$-year-old gametophyte culture at Marietta is a very dense mass of prothallia. These are one cell in thickness and may show limited regions of new growth, but otherwise are very little advanced beyond the early prothallium stage. In those observed, antheridia and archegonia had not developed. The prothallia growing on less crowded areas of the pot, such as the steep sides, have become much larger, showing considerable new proliferation. All those examined possessed reproductive organs. Even after six years, these relatively uncrowded plants were observed

to produce a few sporophytes, though none have appeared recently.

The drawing illustrates one of these larger, fertile prothallia. Two lateral proliferations have developed, neither of them with sex organs. The main thallus has three regions bearing antheridia and one bearing archegonia, as indicated.

As Mottier suggested, fern gametophytes will probably grow indefinitely if no sporophytes develop. He carried on his experiment for four years; the Marietta plants are now in their eighth year, which to the authors' knowledge constitutes a record. We hope to continue observations indefinitely on this culture, and to report on its condition every five years.

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MARIETTA COLLEGE AND UNIVERSITY
OF PENNSYLVANIA.

Collecting Ferns in the Colombian Llanos

ELBERT L. LITTLE, JR., and RUBY RICE LITTLE

Puerto López was selected for botanizing because it is representative of the llanos of northeastern Colombia and because it was accessible for a two weeks' vacation. We wanted a chance to thaw out in the hot country of the tropics after having lived in the cool, rainy Andes at Bogotá, elevation 8,500 feet, where we were employed as botanists by the Foreign Economic Administration. Not shown on most maps, Puerto López is a new, frontier town in the Intendencia del Meta at the edge of the sparsely settled Indian country and down in the hot lowland at an elevation of only 800 feet above sea level. It is on a recently constructed "highway," or auto road. east from Bogotá, the capital of Colombia, and is also at the head of navigation on Río Meta, a tributary of Río Orinoco of Venezuela.

Travel in the tropics, other than by airplane, is slow and uncertain, and our two-day bus trip of only 130 miles from Bogotá to Puerto López was no exception. The first day, July 24, 1944, we crossed over the Cordillera Oriental of the Andes at about 11,000 feet elevation and then continued down a winding, narrow road, expecting to slide or bounce off into some canyon. In addition to the usual waits for one-way traffic along narrow, dangerous portions of the road, we were delayed about two hours while a crew leisurely shoveled a landslide off the road. Before night we arrived at Villavicencio, capital of the Intendencia del Meta, in the hot country at the foot of the Andes. The next day on the plain eastward, our bus stalled for three hours in a mud hole in the middle of the highway. Arriving at Puerto López, we found no hotel and not even a *pensión* or spare room in the village. Finally a room was vacated for us, and we settled down for nine days of botanizing in the llanos.

Llanos, a Spanish word for plains, refers to the nearly level, tropical, grassy plains of northeastern Colombia. The vegetation around Puerto López is mostly tropical grassland, composed of tall, coarse, bunch grasses and resembling the tall grass prairies of the central United States. In the upland grassland are scattered patches of dry forest with low, scrubby trees and shrub thickets. A flood plain forest, or wet forest, of large tropical trees is present in the valleys of Río Meta and tributaries, where the soil is continually moist. The pronounced dry season from December to February apparently prevents the occurrence here of the tropical rain forest and many associated tropical ferns.

A short trip the first day into the grassland and dry forest revealed three characteristic upland ferns: *Adiantum serrato-dentatum* Willd., the only common fern of the grassland but occurring also in the thickets; *Lygodium venustum* Swartz, with fronds climbing 6 to 12 feet high on shrubs at edges of thickets; and a simply pinnate form of *Adiantum latifolium* Lam., growing in moist soil under a dense thicket. Afterwards we found the usual (bipinnate) form of the last species common in the flood plain forest. The second day in the upland we noted a small sterile *Selaginella* commonly forming a carpet-like cover on moist soil under shrubs. A few days later in a burned grass pasture we recognized a few young, sterile plants of the bracken, *Pteridium aquilinum* (L.) Kuhn, which is rare in this locality. On another day in the upland, four additional ferns were collected, making a total of nine upland ferns in the llanos. *Polypodium leucatomos* Poir., with large fronds 2½ feet long, was growing on the trunk of a palm; it is closely related to *P. aureum* L., of Florida, and the American tropics generally. The other three, *Dryopteris permollis* Maxon & Morton, *Lindsaea stricta* (Swartz) Dryand., and *Trichomanes pinnatum* Hedw., were in a deep, man-made ditch

along the road through the grassland. The last was found also in the flood plain forest.

More time was spent exploring the flood plain forest of Río Meta and its tributary *caños*, because of the much richer display of trees, ferns, and other plants there. In open, moist soil where the forest had been cut, three large ferns with coarse, spreading fronds 2 to 5 feet long were common: *Tectaria incisa* Cav., *Dryopteris gemmulifera* Hieron., and *D. serrata* (Cav.) C. Chr. Less frequent, smaller ferns in similar areas were *Pityrogramma calomelanos* (L.) Link, easily recognized by the powdery white under-surface of the fronds, and *Asplenium abscissum* Willd.

Our first trip to the flood plain forest yielded three species of *Polypodium* on tree trunks, including a second species familiar to us in the United States, *Polypodium polypodioides* (L.) Watt. The other two, both rare epiphytes here, *P. plumula* H. & B. and an unidentifiable specimen in the group of *P. pectinatum* L., had narrow, drooping fronds 1 to 2 feet or more in length. Our prize that day was another climbing fern, a peculiar form doubtfully identified as *Lygodium micans* Sturm, which is rare in Colombian collections. The next day we were fortunate in finding a single plant of *Lophidium elegans* (Vahl) Presl, another member of the Schizaeaceae, with the two species of *Lygodium*. *Lindsaea lancea* (L.) Bedd. was collected also.

In the cutover flood plain forest we were attracted to a giant *higuerón* tree, related to the cultivated fig. Examination of the large, buttressed trunk revealed two epiphytic spleenworts, *Asplenium serratum* L., the American bird-nest fern, with a rosette of large, broad, simple fronds 18 to 30 inches long, and the smaller *A. auritum* Swartz.

Slowly, our fern collection was growing. One day in the wet forest we found two vine-like ferns, *Lomariopsis*

japurensis (Mart.) J. Smith and *Lomagramma guianensis* (Aubl.) Ching, both with rhizomes twining 3 to 6 feet high around bases of trees and shrubs and with fronds $1\frac{1}{2}$ to $2\frac{1}{2}$ feet long. They apparently are rare in Colombian collections. The latter has an odd distribution, from southern Brazil north to the Guianas and West Indies and east to Colombia, and is the only representative of *Lomagramma* in the Americas.

During the last three days of botanizing in the flood plain forest along Río Meta, we raised the total of epiphytic ferns to ten species by adding four rare ones. The smallest was a greatly reduced tiny form of a filmy fern, *Trichomanes Krausii* Hook. & Grev., with fronds only an inch high, growing with bryophytes on prop-roots of a palm. Scarcely resembling a fern, *Vittaria lineata* (L.) J. E. Smith had linear, grasslike fronds 4 to 8 inches long. Two epiphytic polypodys, *Polypodium phyllitidis* L. and *P. persicariifolium* Schrad.. and a vine climbing to 3 feet high on shrubs. *P. repens* Aubl.. increased the number of species of *Polypodium* to seven. Five additional shade ferns were found on the forest floor: *Adiantum terminatum* Kunze, *A. pulverulentum* L., *Asplenium melanopus* Sodiro, *Dryopteris protensa* var. *funesta* (Kunze) C. Chr., and *Selaginella horizontalis* (Presl) A. Br.

As our vacation came to a close, we packed our specimens and returned by bus to Bogotá, delayed the first day by a flat tire and the second day by engine trouble. We had found in nine days within a three-mile radius of Puerto López the 34 species of pteridophytes already mentioned. Most of these have no distinctive common names but are known merely as *helechos*, the Spanish word for ferns. No tree ferns were seen here. This local collection is an example for the llanos, where a rich fern flora is not to be expected. Our thanks are due Dr. William R. Maxon and C. V. Morton, of the United States National Herbarium, Smithsonian Institution, for making the final determinations.

Botrychium multifidum in Virginia

WARREN HERBERT WAGNER, JR.

The Leather Grape-fern, *Botrychium multifidum* (S. G. Gmel.) Rupr., is a northern plant known definitely to occur as far south as Pennsylvania, where it is rare, and it has recently been reported from Baltimore County, Maryland.[1] The discovery of this species at Big Meadows (alt. 3500 ft.), Shenandoah National Park, Madison County, Virginia, on January 12, 1946, is therefore of unusual interest, especially in view of the recent range extensions to the southward of others of our northern grape-ferns.

During the last decade the discoveries representing southward extensions of *Botrychium lanceolatum* in Giles Co., Virginia,[2] *B. matricariaefolium* at various places in Maryland, the District of Columbia, and Virginia,[3] and *Botrychium simplex* in Montgomery Co., Maryland,[4] pose an interesting problem: Are these grape-ferns actually spreading southward, or had fern students merely been overlooking them through those many years when they were known only as far south as Pennsylvania or northern Maryland? I believe the latter is the case. Grape-ferns are extremely elusive plants to find, being small and growing, as they frequently do, in grassy and brushy locations. Success in finding them generally requires considerable effort. For this reason, and in the hope that it will benefit other field workers, I shall record here the circumstances under which we discovered *B. multifidum* in Virginia.

As to finding new stations of this fern, Dr. Edgar T. Wherry had advised me to locate brushy fields in which

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[1] Reed, C. F., Bull. Nat. Hist. Soc. Maryland **13**: 47. 1943.
[2] Wood, C. E., Jr., Rhodora **44**: 521. 1942.
[3] Fessenden, G. R., Amer. Fern Journ. **35**: 105–108. 1945.
[4] Ibid. p. 106.

the hair-cap moss, *Polytrichum*, was common. Following this advice I discovered a previously unknown stand at Bernville, Berks Co., Pennsylvania. In the Shenandoah National Park, with the assistance of Dr. E. H. Walker, G. B. Van Schaak, and M. L. Steinacker, a situation was sought where similar conditions prevailed. At Big Meadows, along the Swamp Trail, we found the *Polytrichum* forming mats in fields of low grass. Spotted here and there were patches of *Corylus* and a few groups of small oaks and pines. Here we began our search. The first grape-fern found was *Botrychium dissectum* var. *obliquum* (Muhl.) Clute. Further search. however, revealed a perfectly typical, juvenile plant of *B. multifidum*. Two hours of careful search by the party turned up 11 additional specimens of the Leather Grape-fern and a considerable number of *B. dissectum*. The locality was revisited on March 3 by another group of naturalists in company with Dr. Robert T. Clausen. We found at this time that the Leather Grape-fern occurs over a very wide area in the northern section of Big Meadows, and several additional fronds, of a considerably larger size than those found previously, were taken; they were cut off well above the buds. so that the living plants would not be injured.

At Big Meadows *B. multifidum* occurs widely over the open grassy slopes and plains around the Swamp Trail, growing often in *Polytrichum* beds, but also at the edge of patches of *Corylus* bushes. in open patches of *Danthonia* grass, and even in dry open woods. In the swamp itself *Polytrichum* grows profusely, but we found no specimens here. *B. dissectum*, however. was found in this wetter area, as well as in the open places with the other species. Mr. Van Schaak found a specimen of *B. multifidum* growing so close to a plant of *B. dissectum* that the fronds appeared to come from the same plant.

Both species are, however, readily distinguishable in the field.

The fronds of *B. multifidum* were mostly light green or dirty whitish green, but one unmistakable specimen had segments with narrow pink edges, and the two largest ones found were growing in very sunny places and had a distinct but uneven reddish color. This color was very interesting, in view of the usual evergreen character of this species. The plants of *B. dissectum* are normally bronze in color during the winter, but some individuals at Big Meadows, especially among the younger plants, were dark green. A juvenile specimen of *B. dissectum*, green in color, was found of approximately the same age as a frond of *B. multifidum* (lower right on the accompanying plate). The lobes, however, were longer in *B. dissectum*, the green color was darker, and the texture more herbaceous than in the juvenile *B. multifidum*. The texture of *B. multifidum* was more succulent, and in most specimens the stalk of the frond thicker than in *B. dissectum*. Segments of *B. multifidum* were rounder than those of *B. dissectum* and most specimens (center, top row of plate) have many more segments. A few have only a small number of rounded lobes (the two, halfway down from top, on each side of the illustration). It is very essential, in collecting grape-ferns, to get a representative series of the population, because the range of variation within a species at a given occurrence is usually wide. The specimens illustrated are all small plants collected on our first trip. On the second visit to Big Meadows we found some large specimens, one of the largest having the blade 14.2 cm. broad and 13.5 cm. long.

The forms of *B. dissectum* which are deeply dissected (var. *typicum* Clausen) occur at Big Meadows, together with the simpler form and various intergrades. Some

Frond Forms of the Leather Grape-fern from Madison County, Virginia

of the specimens of *B. multifidum*, including the largest one in the plate, have dentate segments (f. *dentatum* Tryon). Dr. Clausen identified the Big Meadows colony of the Leather Grape-fern as *B. multifidum* subsp. *silaifolium* (Presl) Clausen, and said that the small individuals there that resemble subsp. *typicum* are probably juvenile plants. The differences between *B. dissectum* and *B. multifidum* must be kept clearly in mind in the field, and this may save difficulty in separating them later in the herbarium.[5] While examining Virginia grape-ferns in the National Herbarium in preparing these notes, I found a somewhat shriveled single frond of a grape-fern determined as "*Botrychium dissectum* f. *obliquum* (Muhl.) Fern." which had been taken by Dr. Walker on July 24, 1934 (*Walker* 2551) at Big Meadows during his study of the flora of the Shenandoah National Park. Close examination, however, revealed that this single frond is actually *B. multifidum* and represents apparently its first collection in Virginia. The specimen has a well-developed fertile segment. *B. dissectum* fruits later in the season.

Further exploration for the rare northern grape-ferns may reveal a much wider occurrence in Virginia than suspected. The station for *Botrychium multifidum* here recorded is approximately 60 miles south of the one reported in Maryland,[6] and is an addition to the flora of Virginia. Representative specimens of *B. multifidum* are deposited in the National Herbarium and University of Pennsylvania under my number 2006. *B. dissectum* from Big Meadows is no. 2007.

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[5] For a discussion of this problem, and possible range extension of *Botrychium multifidum* to West Virginia, see Brooks, M. G., and Margolin, A. S., "Pteridophytes of West Virginia." W. Va. Univ. Bull. 39: 2, 10. 1938.

[6] Wherry, E. T., Amer. Fern Journ. 35: 60. 1945.

Shorter Notes

SUPPLEMENTARY NOTE ON LYCOPODIUM HYBRIDS.—The details of this note are intended as an addendum to my recent discussion in this Journal (**35**: 9–20. 1945). Specimens of the supposed hybrids of *Lycopodium complanatum* subsp. *flabelliforme* and *L. tristachyum* were lent me by Dr. Fogg from the herbarium of the University of Pennsylvania from two additional localities in Pennsylvania: Woods on north side of Sharp Mt., 2 km. S. S. E. of Newtown, on the Piedmont Plateau, *P. R. Wagner 7355;* and Sosha Run, Perry County, in the Valley and Ridge Province, *Gress, Jennings and Jennings,* July 25, 1920. Dr. Fogg also let me have for study a collection of what seems to be typical *L. complanatum* subsp. *complanatum* from the Pocono district of the Appalachian Plateau, collected at Tobyhanna, Monroe County. This last record extends slightly farther southward the known range of the subsp. *complanatum* as stated on p. 17 of my article cited above.—ROBERT T. CLAUSEN, Cornell University.

BRACKEN IN THE BOMBED AREAS OF LONDON.—Mr. J. Edward Lousley has investigated and reported upon the plants which have appeared in the bombed areas of central London—the "City." This is the oldest part and was very solidly built up; some of it may have been occupied by buildings since Roman times and all of it has been for a very long time, except for a brief period after the great fire of 1666. Mr. Lousley is justly annoyed because the opportunity of studying the natural recolonization of an area long without a flora has been largely spoiled by well-meaning persons who have sown garden seeds (and, of course, their accompanying weeds) on the ruins in an attempt to beautify them.

There is no doubt, however, as to the natural origin of one species which has proved one of the commonest of

the immigrants—the Bracken, *Pteridium aquilinum*. Mr. Lousley's account of it is worth quoting entire:

". . . Very abundant throughout the City, especially in basements which have been exposed and not filled in. Even before the present war it was to be seen in Hounsditch (Lousley in *Journ. Bot.*, 1939, 181), on the remains of a building demolished to ground level, and I understand it also occurred in several places in gloomy basement areas. In 1943 young Bracken plants were to be seen scattered about the City, but it was not until 1944 that the fern could be said to be abundant. The favourite habitat is in the exposed basements of buildings which have been demolished to ground level, and there can be no possible doubt that it has originated from wind-borne spores. Even if fragments of rhizome were occasionally brought in by some means the growing plants could seldom penetrate the thick walls between the basements and hence it is clear that the present abundance is due to thousands of separate introductions which could not be otherwise than by spores. Parts of the basements are damp and sheltered from the wind and the sun and it seems that in such conditions favour the germination of the spores and development of the prothalli. But the occurrence of Bracken is not limited to the basements. Near the Coal Exchange in Lower Thames Street in a shaded corner the brickwork of a wall is kept perpetually damp by a leaky pipe or gutter above, and here juvenile Bracken plants about 3 inches long may be seen five feet above the street level. In Allhallows Lane at the side of Cannon Street Station there is a series of waste pipes descending from the station above, and in the cup formed by the jointing of one of these pipes healthy Bracken plants grow some 15 feet above the road. In such places introduction could only be by spores and it seems likely that these are present in the City air in great quantity but only occasionally find suitable places for development."

Mr. Lousley also records Male-fern in a few basements, apparently from spores.[1]—C. A. WEATHERBY, *Gray Herbarium*.

[1] Botanical Soc. and Exchange Club of the British Isles, Report for 1943–44: 882. 1946.

Recent Fern Literature

There has just been published a key to a selected list of northeastern ferns which includes several unusual features.[1] The plan of arrangement is artificial rather than systematic, and multiple characters are used, so that the key-paragraphs really furnish concise descriptions of the species to which they lead. The key proper, covering 59 species, thus spreads over 18 pages, and should prove very helpful to the beginner. The outline drawings are arranged in the same order as the species in the key. Supplementary tabulations comprise: An outline for aid in identification on the basis of sterile fronds alone; a systematic list of the species included; a summary statement of the distribution of the species in Pennsylvania; a check-list of the species in the order used in the key; a glossary of 57 terms used, in part illustrated by drawings; separate indexes to scientific and common names; and a list of the ferns around Johnstown, Pennsylvania, where the author has tried out the keys with success in getting high school students interested in fern study.—**E. T. W.**

Edward Step's "Wayside and Woodland Ferns"[2] has recently appeared in a new revised edition by A. Bruce Jackson of the British Museum (Natural History). This work deals with the native ferns of Great Britain, and in a manner which puts to shame our popular manuals of United States ferns. The descriptions are detailed and accurate, the comments pertinent and interesting. Especially to be commended are the 64 colored plates and 79 plates of drawings and photographs of the ferns

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[1] Canan, Elsie Deane. A Key to the Ferns of Pennsylvania. 110 pages, 59 figures by Elizabeth Trent. The Science Press Printing Co., Lancaster, Pa., 1946 ($1.50).

[2] "Wayside and Woodland Ferns," by Edward Step; revised edition; pp. 1–144. 1945. Frederick Warne and Co. Inc., 79 Madison Avenue, New York City. $4.50.

in their natural habitats. The author admirably refrains from mentioning detailed localities for the rare species, for in Great Britain many of these have been nearly exterminated by the determined efforts of fern "lovers."

Since a large percentage of the species discussed grow also in the United States, this book should be in the library of every American fern student. It is not available at book stores, but may be imported through the publisher's New York agents mentioned below.—C.V.M.

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ERRATA

Page 12, line 33: For "receptables," read "receptacles."

In Dr. Clausen's article on Selaginella the maps (figs. 4 and 5) on pages 77 and 79 have been interchanged.

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American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

EDITORS

WILLIAM R. MAXON

R. C. BENEDICT C. V. MORTON

IRA L. WIGGINS

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American Fern Journal

VOL. 37 JANUARY–MARCH, 1947 NO. 1

Bartholomew's Cobble

C. A. WEATHERBY

In the southwestern corner of Massachusetts, the valley of the Housatonic River is wide and the valley-floor flat or gently rolling. Its even contour is broken here and there by projecting outcrops of the underlying limestone, which form small abrupt hills and ridges, locally known as cobbles. Of these Bartholomew's Cobble is at least one of the largest and by all odds the most picturesque.[1]

This particular cobble is at the bottom of the valley close to the river. It consists of two main summits, one a roughly conical elevation toward the north, the other, larger and higher, somewhat oblong in shape, with the long axis running east and west. Both have on their sides exposed ledges of limestone, mostly of a convenient height for the botanist who wishes to examine their crevices, but rising altogether to an elevation of perhaps 200 feet above the valley-floor. On the south side of the larger summit these ledges form rough terraces; on the other side they drop more steeply and irregularly to the meadows along the river. From the highest points there are agreeable views of the Taconic hills to the west and north along the valley. The river flows close under the smaller elevation, then swings off in a wide curve and returns to drive directly against the rocks at the east end of the larger one. The smaller elevation supports a

---

[1] Who Bartholomew was I do not know; presumably the original owner. According to the Century Dictionary, cobble in the sense of a small hill is "local; U. S." Perhaps it is Berkshire County dialect. In any case, it is to be hoped that no one will try to substitute for so pungent and homespun a term something pseudo-poetic—like "Couching Lion" for "Camel's Hump."

[Vol. 36, No. 4, of the JOURNAL, pp. 97–128, was issued Nov. 19, 1946.]

rather sparse growth of trees, chiefly red cedar; the larger has a much better developed cover of cedar, white pine, butternut, birch, elm, maple, and ash, with a dense grove of hemlocks on the north side. The whole covers an area of perhaps 25 acres; five additional acres of pasture go with it.

ONE OF THE LEDGES AT BARTHOLOMEW'S COBBLE

For many years the Cobble has been a favored picnic-spot and has been pastured. As Miss Mabel Choate remarks in writing of the Cobble in *Horticulture*, it is a credit to the self-restraint of the picnickers and to the good judgment of the owners in avoiding over-grazing that the place has lost none of its beauty and not too much of its flora, and that the cows have merely performed the function of lawn-mowers and kept the grass cropped, but still green and luxuriant, about the base of the ledges. The rocks are still gay with columbines in the spring and with hare-bells in summer; in spite of a comparative lack of leaf-mold, and of rapid drainage.

discouraging to woodland plants.[2] 276 species of flowering plants and ferns have been found in the 25 acres.

Among species of local interest or characteristic of the region may be mentioned spring-beauty (*Claytonia virginica*) and *Anemone canadensis* at the edge of the meadow below the north ledges; squirrel-corn (*Dicentra canadensis*), pepper-root (*Dentaria laciniata*), and horse gentian (*Triosteum aurantiacum*) on the shaded northern slopes, and with them a single individual of the immigrant European orchid, *Epipactis Helleborine*, which has shown a great capacity for making itself at home in the calcareous woodlands of western New England and seems likely to become ubiquitous in such habitats. On the drier and more open upper slopes a dry-ground buttercup, *Ranunculus hispidus*, and one of the golden ragworts, *Senecio obovatus*, are conspicuous in their season; and on the ledges themselves rock cress (*Arabis hirsuta* var. *pycnocarpa*) and pellitory (*Parietaria pensylvanica*) reward close inspection. Moonseed vies with wild grapevines in festooning the rocks on the south side of the smaller summit.

The great distinction of the Cobble, however, is its natural garden of rock ferns. With the single exception of Slender Cliff-brake (and that might yet be found on the shaded and relatively moist rocks on the north side), all the species which inhabit limestone in the latitude of Massachusetts are here represented, for the most part in considerable quantity. Commonest is Maidenhair Spleenwort (*Asplenium Trichomanes*); almost every available rock-crevice is occupied and adorned by a vigorous individual of this dainty fern. I am told that there was once more of it than now; even so, the present display is the best I have ever seen. Next in abundance is Ebony

[2] No wood-ferns of the group of *Dryopteris spinulosa*, no Silvery Spleenwort, no Goldie's Fern and no Narrow-leaved Spleenwort have been found.

Spleenwort (*Asplenium platyneuron*); there would doubtless be more of it were it able to get along in cracks in the ledges, protected from cows; but it needs deeper soil and in search of it ventures so far down the slopes as to be exposed to trampling. Walking Fern (*Camptosorus rhizophyllus*) forms carpets on the tops and sides of ledges and of detached boulders; Purple Cliff-brake (*Pellaea atropurpurea*) grows scattered about the drier rocks; and there are a few small, but vigorous colonies of Wall-rue Spleenwort (*Asplenium cryptolepis*). *Asplenium pinnatifidum* has been unofficially reported, but almost certainly in error. A like error was made in the *Catalogue of Flowering Plants and Ferns of Connecticut*. In that case, the plant concerned proved to be a phase of Scott's Spleenwort with unusually blunt lobes; in all probability that of the Cobble was the same. Dr. Wherry has repeatedly pointed out that *A. pinnatifidum* is not known to grow on limestone, and Scott's Spleenwort has been found at the Cobble.

Aside from the charm of the ferns themselves and their setting, the pteridologist is intrigued by the unusual opportunity for the production of two of the rarest of fern hybrids—*Asplenium cryptolepis* × *A. Trichomanes*, known only from a single occurrence in Vermont discovered forty years ago by Grace A. Woolson, and *A. cryptolepis* × *Camptosorus rhizophyllus*, likewise known only from a single station, recently found in Ohio by Prof. E. Lucy Braun.[3] So far, neither has been found at the Cobble; even so keen-eyed and indefatigable a searcher as Mr. Richard Harlow has looked for them in vain. But the possibility is there, as it is in few other

[3] For the former, see Rhodora **8**: 12 (1906) and Fern Bulletin **16**: 46 (1908); for the latter, Amer. Fern Journ. **29**: 133 (1939). In consulting the first two references it should be borne in mind that since their time *A. cryptolepis* has been separated from the European *A. Ruta-muraria*, to which it was previously referred.

places; given a favorable season, a chance juxtaposition of prothallia and rain at the right time and they may appear. As already noted, Scott's Spleenwort has been found, though not recently.

Fern-lovers may rejoice that the Trustees of Public Reservations of Massachusetts, with aid from the Founders' Fund of the Garden Club of America, have been able to purchase the Cobble and are now engaged in raising a fund sufficient to ensure the presence of a warden for at least six months of the year. The Conservation Committee of the Garden Club of America and the Lenox Garden Club have also shown an active interest, greatly appreciated by the Trustees; and the New England Wild Flower Preservation Society is to act as custodian without financial responsibility. The Cobble will be kept in its natural condition.

Since the Trustees form an organization unique, so far as I know, in this country (though it has vigorous offspring in the British National Trust), some account of it should be of interest to our readers in other states. It was founded some 55 years ago by a group of public-spirited citizens for the purpose, to quote its charter, of holding and opening to the public "beautiful and historical places and tracts of land" in Massachusetts. It now owns and administers 22 reservations of from seven to over one thousand acres in various parts of the state, and it has not been at all indifferent to considerations of natural history in choosing them. They include, along with William Cullen Bryant's homestead, Hawthorne's Old Manse, and various beauty-spots, dinosaur-tracks at Holyoke; Monument Mountain, one of the northernmost stations for Mountain Spleenwort; a colony of rhododendrons and one of holly; the Crane Memorial Beach, including the famous Ipswich sand-dunes; and now, the Cobble. All are bird sanctuaries.

The Trustees have remained a private corporation, supported by voluntary subscriptions and the income from a modest endowment. As such, they have a power of quick action and an administrative discretion often denied to Government agencies, with which, however, they work in harmony. Their organization has served its purpose well for half a century; it may serve as a model for similar bodies in other states and as an incentive to like good work in conservation.

GRAY HERBARIUM, HARVARD UNIVERSITY.

Unlisted Pteridophyte Binomials in Eaton's "Manual of Botany"

E. D. MERRILL

In this consideration of the hitherto unrecorded new names for pteridophytes appearing in the several editions of Eaton's pioneer "Manual of Botany," edition one (1817) to edition eight (1840), minor variants due to typographical errors are not listed as new names except in one case, in which the initial letter of the specific name is involved. Those noted for the ferns and the fern allies are *Asplenium rhyzophyllum*, ed. 1, 121, 1817, corrected in all succeeding editions to *A. rhizophyllum* [L.]; *Asplenium crucitarium*, ed. 1, 122, 1817, correctly entered in all succeeding editions as *A. cicutarium* [Sw.]; *Blechnum surrulatum*, ed. 8, 158, 1840, correctly entered in all preceding editions as *B. serrulatum* [Rich.]; and *Pteris aqualina*, in editions 6, 7, and 8, correctly entered in all of the earlier editions as *P. aquilina* [L.].

No authorities are cited for the generic names in any of the editions, except for a very few new ones. Authorities for binomials are lacking in editions one (1817) and two (1818); they were added in a most sketchy manner, and with a remarkably high percentage of error, in edi-

tion three (1822) and succeeding issues. Localities are not indicated in edition one (1817) but were added in edition two (1818), though in an exceedingly abbreviated form: H for Harvard College, vicinity of Boston; Y for Yale College, vicinity of New Haven; C for Columbia College, vicinity of New York City; W for Williams College, Williamstown; N for Northampton; A for Albany; P for Pennsylvania; and O for "omnibus locis," with various additions and modifications in later editions.

All editions follow the Linnaean system of classification as to genera, for Eaton was a strict (and our last) follower of that system. Beginning with edition two (1818), in that part of the text dealing with the species the genera are arranged in a strictly alphabetic sequence from *Acalypha* to *Zizania*, including those genera of cellular cryptogams that the author considered; beginning with edition six (1833), the cellular cryptogams were segregated and placed in a second sequence following the treatment of the flowering plants and ferns.

Additions to Christensen's "Index Filicum" and its supplements are indicated in the following entries by an asterisk "*," corrections by the sign "–." The few new Eatonian names do not in any manner affect nomenclature, except possibly in one case; they merely add to synonymy. In addition to the new names that follow, there are for the phanerogams approximately 200 new ones that remain unlisted in our standard indices. These will be dealt with elsewhere at some future date.

*ATHYRIUM ATOMARIUM Eaton, Man. Bot. ed. 3. 197. 1822; ed. 4. 225. 1824 (*A. atomarium* Presl, Rel. Haenk. 1: 40. 1825) = *Cystopteris bulbifera* (L.) Bernh.

Eaton records this from Pennsylvania. In editions five to eight it appears as *Aspidium atomarium*. No authority is cited for either binomial. For the latter,

Aspidium atomarium Muhl. ex Willd. Sp. Pl. **5**: 379. 1810 is the complete citation.

*ATHYRIUM BULBIFERUM Eaton, Man. Bot. 122. 1817; ed. 2, 163. 1818; ed. 3, 197. 1822; ed. 4, 224. 1824 = *Cystopteris bulbifera* (L.) Bernh.

This is recorded in the several editions from Massachusetts, Connecticut, New York, Pennsylvania, and Michigan. *Athyrium bulbiferum* Eaton (1817) invalidates *A. bulbiferum* (Brack.) Copel. (Bishop Mus. Bull. 59: 53. 1929), which ranges from Polynesia to Mauritius. It became *Aspidium bulbiferum* in ed. 5, 120, 1829, and in succeeding editions, the authority being erroneously cited in ed. 8, 141, 1840, as "W" [= Willdenow]. It is properly *A. bulbiferum* Sw. (1801).

*ATHYRIUM PUNCTILOBUM Eaton, Man. Bot. ed. 2. 163. 1818; ed. 3, 197. 1822; ed. 4, 225. 1824 = *Dennstaedtia punctilobula* (Michx.) Moore.

This is recorded from Pennsylvania, and in edition five "S" is added, meaning the southern United States. It became *Aspidium punctilobum* in ed. 5, 120. 1829. but does not appear in later editions. The specific name was undoubtedly derived from *Aspidium punctilobum* Willd. (Sp. Pl. **5**: 279. 1810) [*Nephrodium punctilobulum* Michx., 1803; *Aspidium punctilobulum* Sw., 1806].

*ATHYRIUM RUFIDULUM Eaton, Man. Bot. 122, 1817; ed. 2, 163. 1818; ed. 3, 197. 1822; ed. 4. 225. 1824 = *Woodsia ilvensis* (L.) R. Br.

Eaton first recorded this from Pennsylvania, and later from Massachusetts, Connecticut, New York, and Michigan. In edition 5, 120, 1829; 6, 36, 1833; 7, 178. 1838; and 8, 141, 1840, it became *Aspidium rufidulum*, still without designation of an authority. It may safely be assumed that *Aspidium rufidulum* Sw. (1806) was in-

tended. a name based on *Nephrodium rufidulum* Michx. (1803).

*ATHYRIUM TENUE Eaton, Man. Bot. 122. 1817; ed. 2, 163. 1818; ed. 3, 197. 1822; ed. 4. 225. 1824 = *Cystopteris fragilis* (L.) Bernh.

No locality was indicated until edition three appeared, where the species is listed as occurring near Troy and New York City, and in Pennsylvania; later its range was extended to the southern states and to Michigan. It became *Aspidium tenue* in ed. 5, 120. 1829; ed. 6, 36, 1833; ed. 7. 178, 1836, still without citation of an authority; but in ed. 8, 141, 1840, it was erroneously credited to "W" [= Willdenow]. The proper entry is *Aspidium tenue* Swartz (Syn. Fil. 86. 1806), this name being based on *Nephrodium tenue* Michx. (1803). If a more definite reduction be desired, it is *Cystopteris fragilis* (L.) Bernh. var. *Mackayii* Lawson, Fern Fl. Canada 233. 1889; see Weatherby, Rhodora **37**: 377. 1935.

Here Mr. Weatherby cites "*Athyrium tenue* Presl, Rel. Haenk. 1. 39, in obs. (1825)," a binomial not listed in Christensen's "Index Filicum." The Presl entry follows the description of *Athyrium fumaroides* Presl, thus: "Affine A. tenui et fragili; a priore differt pinnulis pinnatifidis. soris dorso laciniarum insidentibus." There is no description and no indication of the source of the specific name. In any case, whether this Presl entry be accepted as publication or not, Eaton's name has eight years priority.

*HYPOPELTIS OBTUSA Torr. Compend. Fl. North. Mid. States 380. 1826; Eaton, Man. Bot. ed. 5, 1829; ed. 6, 185. 1833; ed. 7, 347. 1836; ed. 8, 281. 1840 = *Woodsia obtusa* (Spreng.) Torr.

This was recorded from New York and from Pennsylvania. It appears in editions two to five as *Aspidium*

obtusum with the authority for the name in editions three to five indicated, by error, as "W" [= Willdenow]. It is *Aspidium obtusum* Sw. (Syn. Fil. 420. 1806). Eaton undoubtedly took his binomial from Torrey's work, where it is actually described, without, however, a citation of its name bringing synonym. Mr. C. A. Weatherby called my attention to this.

*LYCOPODIUM CELAGO Eaton, Man. Bot. ed. 6, 215. 1833; ed. 7, 382. 1836; ed. 8, 309. 1840 = *Lycopodium Selago* L.

This was recorded from the White Mountains of New Hampshire. It appears correctly in ed. 5, 286. 1829, as *Lycopodium Selago;* the spelling "celago" in the later editions was apparently due to an undetected typographical error.

+SCHIZAEA TORTUOSA Pursh ex Muhl. Cat. 98. 1813, *nom. nud.;* ed. 2, 102. 1818, *nom. nud.;* Eaton, Man. Bot. 123. 1817, *descr.* "(one-sided fern) frond simple spikes one-way." = *Schizaea pusilla* Pursh (Fl. Amer. Sept. **2**: 657. 1814).

In editions two to eight of Eaton's work this appears as *Schizaea pusilla* Pursh. In both editions of Muhlenberg's work the binomial is credited to Pursh and is strictly a *nomen nudum*, there being no indication of either the habitat or the locality. It may be assumed that *Schizaea tortuosa* was a Purshian manuscript or herbarium name, and that when he published his description in 1814 he merely selected the other specific name. This is a minor correction to the confused entry in Christensen's "Index Filicum" (p. 616, 1906), where it appears as "*tortuosa* Mühl. Cat. 102. 1813 (? 1818 nomen ?) = *S. pusilla.*"

ARNOLD ARBORETUM.

A New Form of Asplenium platyneuron

J. E. BENEDICT

Last October I spent a week-end in St. Mary's County, Maryland, along the lower Potomac River. While walking along a woodland road I noticed a fringe of Ebony Spleenwort growing on the low bank at the edge of the road. Among the plants was a fern that I took at first glance to be another species. A closer inspection, however, showed it to be an unusually luxuriant plant of Ebony Spleenwort, with fronds more dissected than is characteristic of any of the named forms or varieties.

The plant was growing in the Gum-Pine association common to this section, in which the dominant species are Sweet Gum (*Liquidambar styraciflua*) and Loblolly Pine (*Pinus taeda*). Associated plants were *Ilex opaca*, *Myrica cerifera*, and *Quercus rubra* (Spanish Oak), with an undergrowth of *Vaccinium*, *Gaylussacia*, and other plants. The soil, locally called "white oak soil" because of its extreme hardness, is known as Leonardtown loam, a form in which clay predominates.

ASPLENIUM PLATYNEURON f. **dissectum** Benedict, f. nov.

A f. *typica* pinnis usque ad 4 cm. longis, subpinnatis, segmentis 7–11-jugis, anguste oblongo-spathulatis, subpinnatifidis, ala costali perangusta vel subnulla recedit.

Type in the U. S. National Herbarium, No. 1,896,275, collected in woods along "Back Road" at Lanedon (Valley Lee P.O.), St. Mary's County, Maryland, October 21, 1945, by J. E. Benedict (No. 5230).

This form is nearest to f. *Hortonae* (Davenp.) L. B. Smith, of which an isotype is in the National Herbarium, but in that form the pinnae are only pinnatifid (the costal wing being relatively broad) and the segments are subentire. In f. *dissectum* the plants are almost bipinnate-pinnatifid, the primary pinnae being pinnatisect nearly or quite to the costa and the ultimate segments deeply pinnatifid.

A Check-list of the Ferns of Arizona

WALTER S. PHILLIPS

(Continuation)

CHEILANTHES PRINGLEI Davenp.

A rare fern which is locally abundant in the Tucson Mts., where it covers rocky north-facing slopes of igneous rock, 3,000 to 5,000 ft. PIMA: Baboquivari Mts., Fresnal Canyon, *Peebles* 8801 (S). Tucson Mts., *Thornber* 2542, 5314, 5315. Santa Catalina Mts., *Swingle* 875. Maxon (10) lists Gila and Cochise Counties also.

CHEILANTHES PYRAMIDALIS var. ARIZONICA (Maxon) Broun.

COCHISE: Chiricahua Mts., Rucker Canyon, in rich soil in dense woods, 7,000 ft., *Phillips* 2858. Huachuca Mts.: *Lemmon;* Ramsey Canyon, *Goodding* 760, 1327; Tungsten Reef Mine, in moist soil in open, sunny situations, 7,100 ft., *Phillips et al.* 2566.

CHEILANTHES TOMENTOSA Link.

On rocky slopes in soil-filled crevices in southeastern Arizona. 5,000 to 7,000 ft.; best developed in partial shade. COCHISE: Huachuca Mts.: Miller Canyon, *Phillips* 2803; Ramsey Canyon. *Goodding* 727. GRAHAM: Pinaleno Mts., Wet Canyon, *Phillips et al.* 2514. PIMA: Baboquivari Mts.: Baboquivari Peak, *Gould et al.* 2787; Baboquivari Canyon, *Peebles* 540 (S); *Harris & Swift* 7737 (S). Santa Catalina Mts.: Mt. Lemmon, *Lemmon;* Butterfly Peak, *Phillips* 2387, 2394. SANTA CRUZ: Santa Rita Mts., Madera Canyon, *Benson* 11315.

CHEILANTHES VILLOSA Davenp.

On dry ledges or in crevices, usually on or near limestone, in the southern part of the state, 2,000 to 4,000 ft. COCHISE: Mule Mts., *Goodding* 1390. PIMA:[6] Rincon Mts., Colossal Caves, *Darrow* 2135. PINAL (MARICOPA?): Sierra Estrella, *Loomis et al.* 3296 (S). YUMA: Kofa Mts., *McMurray* 1294.

CHEILANTHES WOOTONII Maxon.

On exposed rocky hillsides and canyons of igneous rock, 3,000 to 8,800 ft. COCHISE: Bowie, *Jones* 4268. Chiricahua Mts., Rucker Canyon, *Phillips & Darrow* 2774. Huachuca Mts., Carr Canyon. *Phillips et al.* 2545, 2549. COCONINO: Elden Mt., *Bradley & Whiting* (N). Grand Canyon, Bright Angel Trail, *Thornber* 8276: *Collom.* GILA: Sierra Ancha, Aztec Peak, *Harrison* 7861 (S).

[6] Maxon (10) lists the Santa Catalina and Santa Rita Mts. also.

GRAHAM: Galiuro Mts., High Creek, *Pultz & Phillips* 1831, 1853. 1854. Pinaleno Mts., Noon Creek, *Kearney & Peebles* 14106; *Peebles* 14532 (S) (a small piece of *C. fendleri* intermixed). MARICOPA: Superstition Mts., *Darrow*. PIMA: Coyote Mts., *Phillips* 2618. Rillito Mts., *Johnson*. Rincon Mts., Happy Valley, *Phillips & Pultz* 2725, 2734, 2753. Santa Catalina Mts.: Castle Rock, *Griffiths* 2127; Control Mine, *Phillips* 2315; Stratton Mine, *Peebles et al.* 2556 (S); Pima Canyon, *Thornber & Brown*. Palisade Ranger Station, *Phillips* 2411; Soldier Canyon, *Benson* 11149; Lemmon Lookout, *Phillips & Darrow* 2579; Sabino Canyon, *Thornber* 2273. PINAL: Picacho Mts., *Loomis* 733 (S); *Peebles et al.* 6500 (S). Oracle, *Thornber*. Pinal Mts., Miami-Superior Highway, *Kearney & Peebles* 9245 (S). SANTA CRUZ: Patagonia Mts., Sycamore Canyon, *Phillips* 2790. Santa Rita Mts., Madera Canyon, *Thornber*. Maxon (10) lists Yavapai County also.

CHEILANTHES WRIGHTII Hook.

Rocky fields and slopes, in exposed places in the oak-woodland and chaparral; common between loose boulders in broader valleys. 2,000 to 6,000 ft. COCHISE: Bowie, *Jones* 4248. Chiricahua Mts., Ryolite Canyon, *Clark* 9114 (C). Huachuca Mts., Carr Canyon, *Phillips et al.* 3546. GILA: Sierra Ancha, Parker Creek, *Little* 4197. GRAHAM: Galiuro Mts., High Creek, *Pultz & Phillips* 1815. Pinaleno Mts., Swift Trail, *Peebles* 14522 (S). MARICOPA: Mormon Flats, *Peebles & Loomis* 1000 (S). PIMA: Baboquivari Mts., Fresnal Canyon, *Peebles* 8804 (S). Coyote Mts., *Harrison & Kearney* 8012 (S); *Phillips* 2603. Santa Catalina Mts.: Bear Canyon, *Thornber* in 1901; Sabino Canyon, *Thornber* in 1903: *Harrison & Kearney* 7242 (S); Soldier Canyon, *Shreve* 5117 (this collection cited by Maxon (15) in the original description of *C. wootoniii*. The University of Arizona sheet from the Shreve Herbarium is *C. wrightii*). Santa Rita Mts., Florida Canyon, *Phillips* 2804. Sierrita Mts., *MacDougal*. Tucson Mts., *Spalding; Thornber* 2355. PINAL: Superstition Mts., *Peebles & Fulton* 6380 (S). Maxon (10) lists Greenlee and Santa Cruz Counties also.

CYSTOPTERIS BULBIFERA (L.) Bernh.

COCONINO: Oak Creek Canyon, *Deaver*. Maxon (10) cites also *Goldman* 2188, from the same locality at 5,400 ft.

CYSTOPTERIS FRAGILIS var. TENUIFOLIA (Clute) Broun.

A common fern in the forested areas of higher altitudes; very common in the Western Yellow Pine forests in moist areas about

rocks, 5,000 to 12,000 ft. APACHE: White Mts.: Big Lake, *Phillips* 2814; Hannagan Meadows, *Phillips* 2812. COCHISE: Huachuca Mts.: *Lemmon;* Carr Canyon, *Goodding* 301; Ramsey Canyon, *Shreve* 5034; *Goodding* 743. COCONINO: Grand Canyon: *MacDougal:* Bright Angel Trail, *Thornber* 8273. San Francisco Mts., *Little* 4629; *Whiting & Sanders; Phillips & Darrow* 2837, 2838. Walnut Canyon, *Deaver; Whiting* (N). GILA: Mazatzal Mts., Hell Canyon, *Harrison et al.* 7840 (S). Sierra Ancha, Workman Creek, *Little* 4301. GRAHAM: Pinaleno Mts.: Columbine Trail, *Shreve* 4316; Lookout at 9,357 ft., *Phillips et al.* 2504; Mt. Graham, *Peebles et al.* 4409 (S); Sawmill, *Thornber & Shreve* 7749; Turkey Flat, *Kearney & Peebles* 14116 (S); Wet Canyon, *Phillips et al.* 2477; Marijilda Canyon, *Phillips et al.* 2486, 2487, 2488; Post Canyon, *Phillips et al.* 2509, 2510. NAVAJO: Betatakin Canyon, *Wetherill* (N). PIMA: Baboquivari Mts., *Gould et al.* 2783. Rincon Mts.: Happy Valley, *Phillips* 2864; Spud Rock, *Blumer* 3460. Santa Catalina Mts.: Butterfly Peak, *Phillips* 2308; Marshall Gulch, *Phillips* 2379; Mt. Lemmon, *Harrison et al.* 8073, 8074 (S); Soldier Camp, *Phillips* 2459. PINAL: Oracle, *Thornber.* SANTA CRUZ: Madera Canyon, *Thornber.*

DRYOPTERIS ARGUTA (Kaulf.) Watt.

Stream sides in a few canyons in central Arizona, 4,000 to 5,000 ft. GILA: Sierra Ancha, Parker Creek, *Little* 4221. PINAL: Queen Creek, above Superior, *Kearney & Smith* 9008 (S). Devil Canyon, above Superior, *Harrison* 2089, 3180 (S). Maxon (10) cites *Goodding* 6151 from the Superstition Mts.

DRYOPTERIS FEEI C. Chr.

In shade on steep wet canyon sides and in silt along stream beds. The Aravaipa Canyon station is on a calcareous deposit, the plants being associated with *Adiantum capillus-veneris.* PINAL: Galiuro Mts., Aravaipa Canyon, *Darrow: Phillips & Reynolds* 2877.[7] YAVAPAI: Santa Maria River, *Hester.*

DRYOPTERIS FILIX-MAS (L.) Schott.

Along shaded mountain streams, often with *Athyrium filix-femina,* and in crevices of shaded cliffs, where it often occurs with *Polypodium hesperium,* 6,500 to 10,000 ft. APACHE: White Mts.: Thompson Ranch, *Goodding* 595; Big Lake, *Phillips* 2817. COCHISE: Chiricahua Mts.: *Loomis & Peebles* 5417 (S); Totem Pole Canyon, *Clark* 8959 (C). Huachuca Mts., Miller Canyon,

[7] Maxon (10) cites *Mohr* in 1873 from the same locality.

Goodding 122, 317; *Darrow* 2558. COCONINO: Elden Mt., *Whiting & Bradey*. Oak Creek, *Deaver*. Sunset Crater, *Wetherill* 1939 (S). GRAHAM: Pinaleno Mts.: *Thornber & Shreve* 7919; Mt. Graham, *Peebles et al.* 4410 (S); Fort Grant, *Goodding* 1049; Columbine CCC Camp, *Phillips et al.* 2507; Marijilda Canyon, *Phillips et al.* 2489. PIMA: Santa Catalina Mts.: Butterfly Peak, *Phillips* 2389; Mt. Lemmon, *Harrison et al.* 8094 (S); Marshall Gulch, *Phillips* 2306, 2295; *Shreve* 5414; Soldier Camp, *Phillips* 2360. Rincon Mts., Spud Rock, *Blumer* 3459.

DRYOPTERIS DISJUNCTA (Rupr.) Morton.

In dense shade on steep wooded slope at about 9,000 ft. APACHE: White Mts., Bonita Creek, *Goodding* 1222. Broun (2) uses the name *Phegopteris dryopteris* (L.) Fée and Maxon (10) *Dryopteris linnaeana* C. Chr. for this plant. For a discussion of the nomenclature see Morton (18).

DRYOPTERIS PATULA var. ROSSII C. Chr.

On moist slopes and canyon walls, 7,000 ft. COCHISE: Huachuca Mts., Ramsey Canyon, *Goodding* 1328. Maxon (10) cites also *Lemmon* in 1882.

EQUISETUM ARVENSE L.

In alder thickets and along streams in meadows in east-central Arizona, 5,000 to 7,000 ft. APACHE: White River, *Harrison* 4867 (S). Little Colorado River at Greer, *Thornber*. COCONINO: Oak Creek, *Whiting & Sanders; Wetherill*. San Francisco Mts.: Schultz Pass, *Bradey & Allen* (N); Flagstaff, *Osborn* 4337a (S). Lake Mary, *Fulton & Osborn* 7144 (S). GILA: Sierra Ancha, Peterson Ranch, *Little* 4302. GRAHAM: Pinaleno Mts.: Mt. Graham, *Peebles et al.* 4411 (S); Sawmill, *Thornber & Shreve* 7799. NAVAJO: Lakeside, *Thornber* 8904; Showlow Creek, *Pultz* 1770. YAVAPAI: Oak Creek, D. A. Ranch, *Fulton* 5931 (S).

EQUISETUM FUNSTONII A. A. Eaton.[8]

COCHISE: Chiricahua Mts., Cave Creek, in sandy soil along stream bed, 5,000 ft., *Shreve* 6354. This is the only collection I have seen from Arizona, although Schaffner (23) mentions it from the state.

[8] The relationships of *E. funstonii*, *E. kansanum*, and *E. laevigatum* are obscure in some of the Arizona specimens and the group needs working over. *E. funstonii* is rather rare in Arizona but *E. kansanum* and *E. laevigatum* are common. Without fruiting material it is hard to distinguish between these species and numerous sheets in Arizona herbaria are omitted because the plants are sterile.

EQUISETUM HYEMALE var. CALIFORNICUM Milde.

Northern and central Arizona along stream beds, 6,000 to 7,000 ft. Confused in Arizona herbaria with *E. prealtum*. COCONINO: Oak Creek, *Fulton* 7379 (S). Flagstaff, *Fulton* 4378 (S). Walnut Canyon, *Whiting* (N). NAVAJO: Betatakin Canyon, *Wetherill* 139. Navajo National Monument, *Wetherill* (S).

EQUISETUM KANSANUM Schaffner.

Along stream beds, high up on dry banks, and on the forest floor in sandy soil under Western Yellow Pine, 5,000 to 8,000 ft. COCHISE: Chiricahua Mts., *Peebles & Loomis* 5425 (S). Huachuca Mts., Ramsey Canyon, *Darrow* 2590a. COCONINO: Flagstaff, *Whiting*. Tuba City, *Kearney & Peebles* 12859 (S). Moe Ave, *Purchace* 312 (S). Grand Canyon: Robber's Roost, *Collom* (G); Fuller Canyon, *Collom* (S). Navajo Mt., *Nichol*. GILA: Sierra Ancha, Rose Creek, *Kearney et al.* 5971 (S); *Little* 4313. NAVAJO: Betatakin Canyon, *Wetherill* 525 (N). PIMA: Santa Catalina Mts.: Mt. Lemmon, *Peebles et al.* 2500a (S), 7710 (S); Summerhaven, *Phillips* 2444. SANTA CRUZ: Oro Blanco Mts., Sycamore Canyon, *Benson* 10963. YAVAPAI: Prescott, *Kearney et al.* 4310 (S).

EQUISETUM LAEVIGATUM A.Br.

Along streams and about springs, often in water, 5,000 to 7,000 ft. COCHISE: Chiricahua Mts., Bonita Creek, *Clark* 8276. Huachuca Mts., *Lemmon* (S). COCONINO: Oak Creek, *Whiting & Sanders*. Homestead, *Armack* (N). Havasu Canyon, *Clover & Jotter* 2359. Grand Canyon, Bright Angel Trail, *Thornber* 8245. PIMA: Santa Catalina Mts., Sabino Canyon, *Thornber et al.* SANTA CRUZ: Santa Rita Mts., Madera Canyon, *Thornber* 445. YAVAPAI: Skull Valley, *Thornber* 8799.

EQUISETUM PREALTUM Raf.

The commonest species of the genus in Arizona; along streams and in moist canyon bottoms in rich soil, sometimes forming dense thickets 3 to 5 feet high, 5,000 to 8,000 ft. COCHISE: Chiricahua Mts., Stephens Ranch, *Blumer* 1496. Huachuca Mts.: Miller Canyon, *Phillips* 2802; Ramsey Canyon, *Goodding* 726; *Peebles et al.* 3507 (S); *Darrow* 2590b. COCONINO: Grand Canyon, Bright Angel Trail, *Thornber* 8307. Havasu Canyon, *Clover* 5267, 4403a: *Whiting* (N). GILA: Sierra Ancha, Parker Creek, *Little*. GRAHAM: Pinaleno Mts.: Sawmill, *Thornber & Shreve* 7879; Wet

Canyon, *Phillips et al.* 2476. NAVAJO: Sagie Canyon, *Whitehead.* Navajo National Monument, *Wetherill* (N). PIMA: Santa Catalina Mts.: Sabino Canyon, *Phillips* 2368; Webber Ranch, *Thornber* 2781; *Thornber & Lloyd* 4192; Marshall Gulch, *Thornber* 5586; *Phillips* 2296; Upper Sabino Canyon, *Phillips* 2404; Mt. Lemmon, *Kearney et al.* 8080 (S). SANTA CRUZ: Madera Canyon, *Benson* 11445; *Phillips* 2863.

ISOËTES BOLANDERI Engelm.

COCONINO: Dude Lake, Mogollon Rim, 8,000 ft., *Phillips & Reynolds* 2892. Pfeiffer (21) cites a single collection (*Coville* 1053) from a lake two miles east of Tunnel Road, Black Mesa Forest Reserve. This is evidently from the same locality as my collection. Dude Lake is about two miles from an old landmark called "The Tunnel," by which passes the Tunnel Trail.

ISOËTES BOLANDERI var. PYGMAEA Clute.

Pfeiffer (21) cites a single collection by Lemmon from the Huachuca Mts., Cochise County.

MARSILEA VESTITA Hook. & Grev.

At scattered stations throughout the state, 1,500 to 7,000 ft.; growing in moist places about lakes, reservoirs, and water holes. The shallow margins of Picacho Lake are covered with acres of this plant and it has been rather heavily grazed by cattle. COCHISE: Underwood & Cook (26) cite a collection by Lemmon in 1882 from near Fort Huachuca. COCONINO: Oak Creek, Foxboro Ranch, *Deaver.* NAVAJO: Lakeside, *Pultz* 1784. PIMA: Rillito Valley, Monthan's Ranch, *Thornber* 5236, 7502. Aguirre Lake, north of Sasabe, *Darrow* 2170. PINAL: Picacho Reservoir, *Phillips & Pultz* 2573.

MARSILEA sp.

GRAHAM: Hooker Cienega, Bonito, 4,400 ft., *Pultz & Phillips* 1814. Mr. Weatherby writes that this specimen is probably not *M. vestita* but some Mexican species. Fruits will be necessary for identification.

NOTHOLAENA ASCHENBORNIANA Klotzsch.

Dry, exposed rocky areas and shallow ravines in broad valleys at about 5,000 ft. COCHISE: Huachuca Mts., Carr Canyon, *Phillips et al.* 2572. Mule Mts.: *Goodding* 1361.[9]

[9] Maxon (10) cites also *Goodding* 1387, and a Pringle collection from the Santa Rita Mts., Santa Cruz or Pima County.

NOTHOLAENA AUREA (Poir.) Desv.

Rocky hillsides and open canyons, usually below projecting boulders or on cliffs where there is extra moisture, 4,000 to 7,000 ft. COCHISE: Bowie, *Jones* 4329. Chiricahua Mts.: Cave Creek, *Phillips et al.* 2530; Picket Canyon, *Clark* 9298 (C); Wilgus Ranch, *Blumer* 2141. Huachuca Mts.: Carr Canyon, *Phillips et al.* 2544; Garden Canyon, *Peebles et al.* 3431 (S); Miller Canyon, *Shreve* 5066. Mule Mts.: Dixie Canyon, *Goodding* 2514; Paul Spur, *Benson* 11123. GILA: Sierra Ancha, Parker Creek, *Little* 4220. PIMA: Baboquivari Mts.: Mendoza Canyon, *Phillips* 2761; Baboquivari Canyon, *Peebles & Harrison* 3963 (S). Rincon Mts.: *Harrison et al.* 7984 (S); Happy Valley, *Phillips & Pultz* 2731; Mountain Spring Canyon, *Gould* 3037. Santa Catalina Mts.: Pima Canyon, *Thornber & Brown* 5234, 5235; Soldier Canyon, *Thornber* 2751; *Phillips* 2276; *Benson* 11147. Santa Rita Mts., Florida Canyon, *Phillips* 2806. PINAL: Galiuro Mts., Holy Joe Peak, *Darrow*. SANTA CRUZ: Oro Blanco Mts., *Kearney & Peebles* 14877 (S), 14894 (S). Santa Rita Mts., Madera Canyon, *Peebles et al.* 1338 (S), 1345 (S). Maxon (10) lists southern Apache County also.

NOTHOLAENA CALIFORNICA D. C. Eaton.

Rare and local in the southwestern part of the state, where it occurs on rocks and in crevices about tanks (water holes) in some of the driest regions of the state, 1,000 to 3,000 ft. YAVAPAI: Maxon (10) cites a collection by Wooton in 1892 from Congress Junction. YUMA: Kofa Mts., *McMurray* 1295, 1296. Tinajas Altas, *Benson & Darrow* 10814.

NOTHOLAENA GRAYI Davenp.

Exposed rocky hillsides in oak-woodland and chaparral of the southeastern part of the state, 4,000 to 6,000 ft. COCHISE: Bowie, *Jones* 4250. Benson-Wilcox Highway, *Darrow*. Huachuca Mts., Carr Canyon, *Phillips et al.* 2569. PIMA: Baboquivari Mts., Baboquivari Canyon, *Kearney & Peebles* 14983 (S). Rincon Mts.: Chimney Creek, *Kearney & Peebles* 10481 (S); Happy Valley, Sycamore Creek, *Phillips & Pultz* 2759a. Santa Rita Mts., Florida Canyon, *Phillips* 2807. SANTA CRUZ: Patagonia Mts.: *Peebles et al.* 4739 (S), 5591 (S), 5596 (S); *Kearney & Peebles* 14818 (S); *Phillips* 2788. Santa Rita Mts., Madera Canyon, *Kimber*. Canelo Hills, *Darrow & Haskell* 2312. Maxon (10) lists Greenlee County also.

NOTHOLAENA JONESII Maxon.

Limestone cliffs and ledges in exposed places, where it can withstand extreme conditions of drought, 2,000 to 4,000 ft. COCONINO: Clover & Jotter (5) cite this species from Vasey's Paradise in Marble Canyon as being fairly abundant. MOHAVE: Meriwitica Canyon, *Whiting* (N). PIMA: Waterman Mts., northeast end of Roskruge Mts., *Darrow & Haskell* 3407. Maxon (10) cites *Whitehead* 1806 from near Superior, Pinal County.

NOTHOLAENA LEMMONII D. C. Eaton.

Occasional in several canyons of the south slopes of the Santa Catalina Mts., along dry stream beds on igneous rocks, otherwise very rare in the southeastern part of the state, 4,000 ft. PIMA: Santa Catalina Mts.: Agua Caliente, *Thornber* 7278; Pima Canyon, *Thornber* 7564; Sabino Canyon, *Thornber* 5227, 5318. Rincon Mts., Chimney Creek, *Kearney & Peebles* 10479 (S). SANTA CRUZ: Tumacacori Mts., El Cajon, *Shreve*. Maxon lists Santa Rita Mts.

NOTHOLAENA LIMITANEA Maxon.

Common on limestone outcroppings in the southern part of the state, and occasional on igneous rocks, 2,000 to 7,000 ft. COCHISE: Dos Cabezas Mts., *Phillips et al.* 2515. Chiricahua Mts.: Cave Creek, *Peebles & Loomis* 5403 (S); Hand's Trail, *Blumer* 1526. Huachuca Mts.: Carr Canyon, *Phillips et al.* 2571; Cave Creek Canyon, *Phillips* 2800; Fort Huachuca, *Phillips* 2794; Garden Canyon, *Peebles et al.* 3398 (S); Ramsey Canyon, *Goodding* 773; Tanner Canyon, *Goodding* 815; Wilcox, *Darrow*. COCONINO: Wupatki National Monument, Antelope Canyon, *Whiting* (N). Vasey's Paradise, *Clover & Jotter* 2253. GILA: Sierra Ancha, Kyle Asbestos Claim, *Little* 4290. PIMA: Ajo Mts., Pitahaya Canyon, *Nichol*. Baboquivari Mts., *Harrison* 4767 (S). Coyote Mts., *Phillips* 2617. Rincon Mts.: Happy Valley, Sycamore Creek, *Phillips & Pultz* 2754a; Colossal Cave, *Darrow* 2136. Santa Catalina Mts., Marble Peak, *Darrow*. SANTA CRUZ: Oro Blanco Mts.: Ruby, *Kearney & Peebles* 14875 (S); Sycamore Canyon, *Darrow & Haskell* 2231. Patagonia Mts., Sycamore Canyon, *Phillips* 2789. Tumacacori Mts., *Shreve*. YUMA: Kofa Mts., *McMurray* 1300. Maxon (10) lists Pinal County also.

NOTHOLAENA LIMITANEA var. MEXICANA (Maxon) Broun.

Maxon (10) cites only one collection from the United States of this southern variety, this from Wilgus Ranch, Chiricahua Mts., Cochise Co., 6,000 ft., *Blumer* 2390.

(To be concluded)

The Status and Distribution of Equisetum arvense ramulosum

WILLIAM F. RAPP, JR.

The taxonomic status of the varieties and forms of *Equisetum arvense*, most of which are based wholly on minor external differences, has long been a source of discussion among botanists. The variety *ramulosum* Rupr. was originally described in 1845 as follows: "In umbrosis: ramulosa i.e. surculo sterili adscendente, ramis quadrangularibus uti in var. decumbente, sed ramulis iterum brevibus ad genicula plura ramorum." In 1882 Klinge reduced this variety to formal status, giving the following description: "Spross aufrecht meist pyramidenförmig. Aeste 4-kantig, secundär verzweigt." This rank has usually been accepted, as for instance by Victorin and by Broun.

Externally this form *ramulosum* differs from typical *E. arvense* in its branching branches, as indicated in the diagrammatic drawings (*figs. 1a, 1b*). A study of the internal anatomy shows a more important difference, for typical *arvense* has 12 carinal canals and vallecular cavities, whereas *ramulosum* has only 10, as shown in the cross sections (*Plate 2, figs. a, b*). Because of these differences in external and internal anatomy I believe it necessary to regard *ramulosum* as a subspecies rather than a form.

EQUISETUM ARVENSE subsp. **ramulosum** (Rupr.) Rapp, comb. nov.

Equisetum arvense var. *ramulosum* Rupr. Beitr. Pflanzenk. Russ. Reich. **3**: 19. 1845.

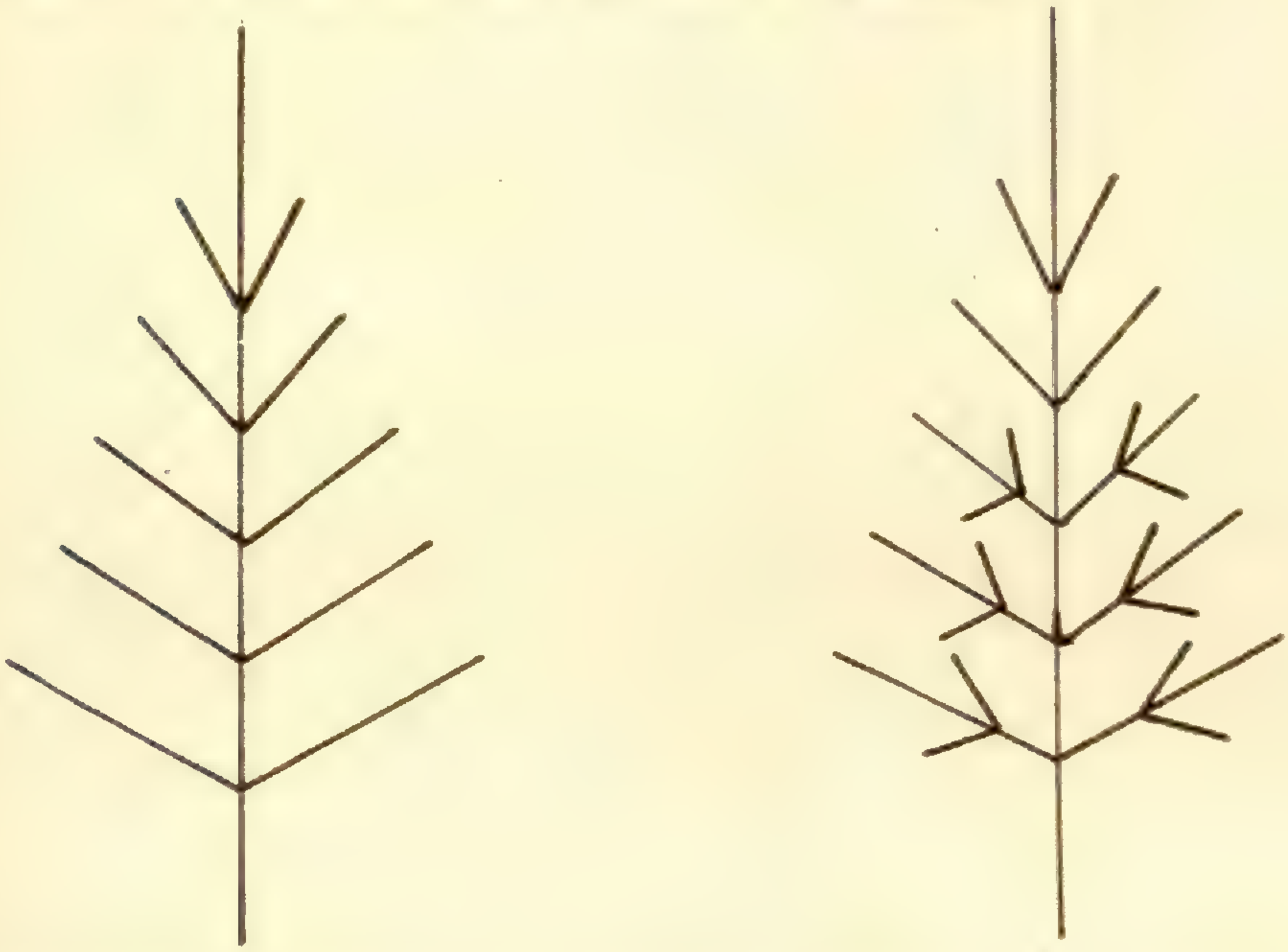
Equisetum arvense f. *ramulosum* Klinge. Arch. Naturk. Liv.-, Ehrst.-, und Kurlands **8**: 369. 1882.

Sterile plants erect, with tetragonal branches, these branching at various points; stems with 10 carinal canals and 10 vallecular cavities.

TYPE LOCALITY: Russia.

STEMS OF EQUISETUM ARVENSE IN CROSS-SECTION; FIG. A (ABOVE), THE TYPICAL FORM; FIG. B (BELOW), SUBSP. RAMULOSUM

Broun states that *ramulosum* is "occasional with the type." Several years ago when collecting in New Jersey I found it by no means rare. It seems to occupy no definite "ecological niche," for I have found it in a pure greensand soil (Cretaceous marl) rich in nitrates and other plant foods, and, at the other extreme, in cinders along railway tracks. Apparently it is no more selective in habitat than typical *E. arvense*.



1a 1b

DIAGRAM OF BRANCHING; 1A, TYPICAL E. ARVENSE; 1B, E. ARVENSE SUBSP. RAMULOSUM

Through the kindness of the curators I have been able to study all the specimens of *E. arvense* in the following herbaria: New York Botanical Garden, University of California (Berkeley), United States National Herbarium, and the University of Montreal. I have studied the specimens at Rutgers University and the University of Illinois also. The following list gives the distribution by counties or other regional localities of subsp. *ramulosum*. I will supply information as to exact stations to anyone interested.

QUEBEC: Anticosti Island, Berthier-en-Bas, Cap St. Ignace, Farm Point, Gaspesie, Labelle, Lonoraie, Matapeclia, Montreal, Pointe du Lac, Rimouski, St. Jerome, St. Pascal, Sheldrake. ONTARIO: Oxford, Prescott. MANITOBA: Marquette. YUKON: Dawson. ALASKA: Akutan Island, Kodiak Island, Copper Center. MAINE: Somerset. NEW HAMPSHIRE: Belknap. VERMONT: Caledonia, Windsor. MASSACHUSETTS: Essex, Middlesex. RHODE ISLAND: Newport (Block Island). NEW YORK: St. Lawrence. NEW JERSEY: Bergen, Burlington, Gloucester, Middlesex, Monmouth, Morris, Sussex. OHIO: Meigs. ILLINOIS: Champaign, Clark, Cook, Dupage, Mason. MICHIGAN: Berrien, Gratiot. WISCONSIN: Juneau, Washburn. NORTH DAKOTA: Benson. MISSOURI: Audrian, Clay, Jackson, Macon, Putman. KANSAS: Riley. DISTRICT OF COLUMBIA (Georgetown). VIRGINIA: Campbell. WEST VIRGINIA: Monongalia. NORTH CAROLINA: Haywood. TENNESSEE: Knox. ARKANSAS: St. Francis. MONTANA: Flathead. IDAHO: Boise. WASHINGTON: Lewis, Snohomish, Walla Walla. OREGON: Douglas. COLORADO: La Plata, Montezuma, Summit. UTAH: Duchesne. NEVADA: Humboldt. NEW MEXICO: Lincoln. ARIZONA: Gila. CALIFORNIA: Amador, Humboldt, San Bernardino.

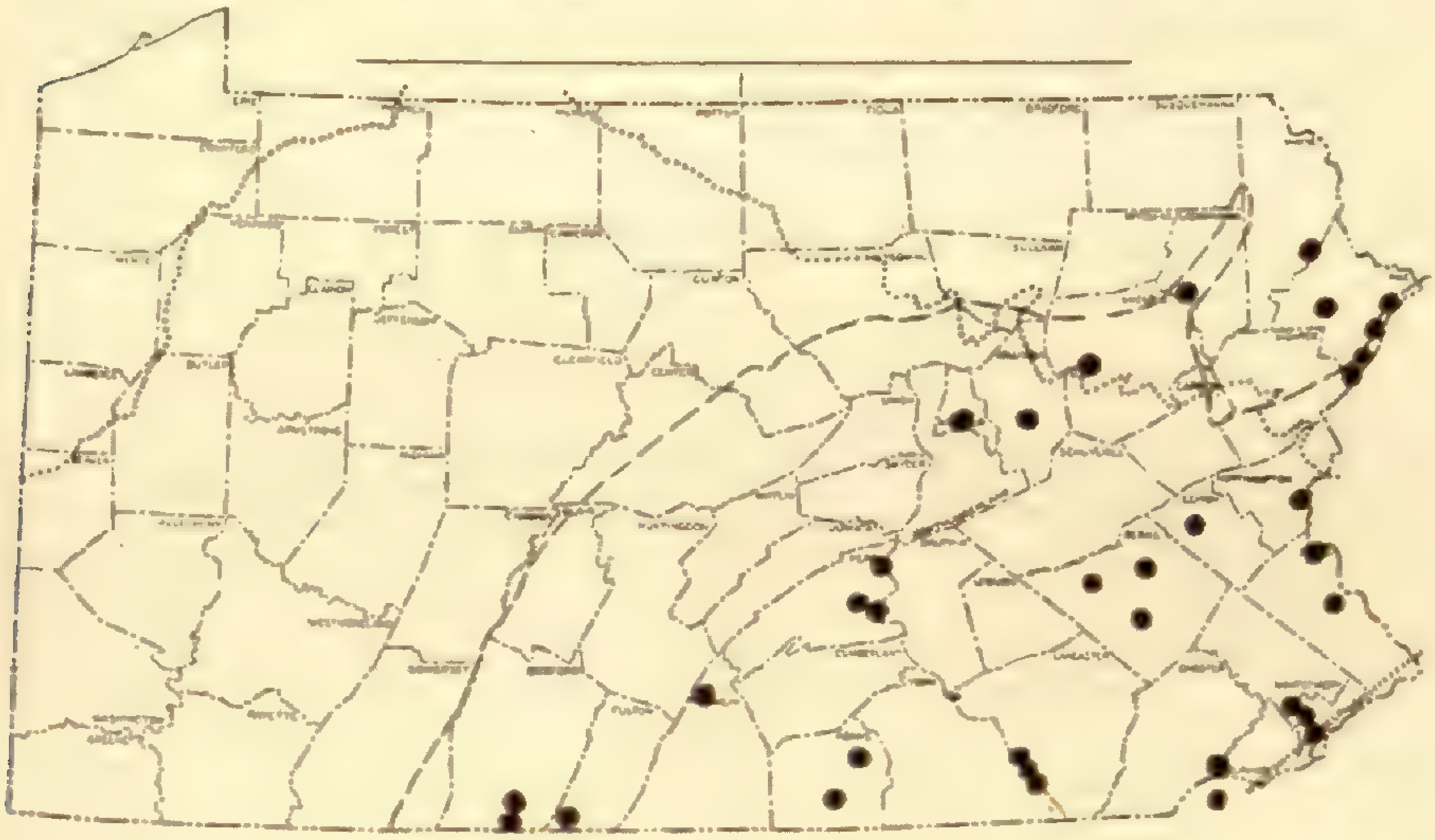
UNIVERSITY OF ILLINOIS.

Shorter Notes

SELAGINELLA RUPESTRIS IN PENNSYLVANIA.—When a map showing the distribution of a plant by dots or other symbols is published, would-be phytogeographers proceed to figure out the significance of the details shown. If there exists a gap in an otherwise rather continuous range, they are inclined to speculate and even to publish upon possible explanations, without realizing that the lacuna may be due to incomplete collecting or compiling of data.

In this Journal (**36**: 68. 1946) there was published a map of the range of *Selaginella rupestris* which furnishes a good illustration of what may happen. The herbaria

which the compiler consulted containing relatively few specimens from certain states, he inserted X's for literature records for Wisconsin, Indiana, and Ohio. However, even though there were collections from but three Pennsylvania stations, no literature records were added for this state. (This was owing to the present writer's failure to publish detailed lists, for which he herewith apologizes.) As a result, the map shows such a conspicuous distributional lacuna here that it is sure to attract the attention of the aforesaid phytogeographers.



In the hope of saving them the effort of explaining this particular lacuna, a map of Pennsylvania is here reproduced, with dots showing the known distribution of *Selaginella rupestris* in this state,—about 40 records, in 20 counties.—EDGAR T. WHERRY, *University of Pennsylvania.*

WINTER PROTECTION OF FERNS.—The manner in which I protect some of the small rock ferns in my garden during the winter months may be of interest to others who have suffered losses due to winter-killing. *Asplenium pinnatifidum* and *Asplenosorus ebenoides* were especially difficult for me; in fact, they never did survive a winter

in my garden when given an ordinary mulch. Inasmuch as I felt sure they could withstand fairly low temperatures, I wondered if snow lying on their crowns for weeks at a time might not be the cause of my failures. So I tried covering them with glass, and to date I have not lost a plant thus protected. I first mulch the ferns with pine needles, then cover them with glass bowls, and on each bowl lay a flat stone to provide shade in the event that we have a thaw with sunshine. If the ferns are growing in the low wall which runs along a part of my garden, I use pieces of heavy glass above the mulch, leaning the glass against the wall, with a stone at the lower edge to prevent it from slipping.

The European variety of Hart's-tongue also gave me some trouble, about half of my plants being lost every winter. A few years before the war I bought a bale of glass wool to use as a mulch, and this material has proven to be perfect for the Hart's-tongues, as I have had no losses since using it. The wool is very light in weight, so it should be covered with chicken wire and the wire anchored with rocks, to prevent its being blown away in even a light breeze. It can be used over and over, if care is taken not to tear it when removing it in the spring. My supply is now in bits and pieces. I was unable to buy any last year, but it may be on the market again in the near future.—GRACE B. GRIFFETH, *Rochester, New York.*

Recent Fern Literature

In an article entitled "A Phylogenetic Study of the Ferns of Burma,"[1] Prof. F. G. Dickason has made what is perhaps the first attempt to apply, in detail and in a definitely limited field, Schaffner's ideas as to phylogeny. The result is a searching, sometimes iconoclastic, but al-

[1] Ohio Journ. Sci. 46: 73–108. 1946.

ways acute and well reasoned, criticism of current phylogenetic theory, rather than a completed system of his own; but it makes good and thought-provoking reading.

Prof. Dickason shares the misgivings which some others have felt at the great amount of parallel development which current systems are forced to assume. With some of the rest of us, he condemns the dogmatic manner in which some of these systems have been put forth. "No fern taxonomist," he writes, "has adequately presented the principles on which he has based his phylogenetic disposition of species." He does not stop there, but goes on to attack what the present reviewer had supposed articles of faith among phylogenists. He does not believe that the Schizaeaceae, Osmundaceae, or Gleicheniaceae were direct ancestors of any group in the Polypodiaceae. He does not believe that the original fern was a *Rhynia*-like, dichotomously branching plant, nor that fern leaves are modified branches. He thinks simple leaves more primitive than dissected. He does not accept Bower's soral classification of Gradatae and Mixtae, though he thinks the Simplices are significant. Neither does he regard Bower's division of the ferns into Marginales and Superficiales as of value. He does not attach any phylogenetic importance to the structure of the stele; it is too dependent on size and posture of the stem. He does not think there is much significance in hairs as against scales.

After all this, he raises his sights still higher to assert that phylogenetic development in general does not advance because of "some assumed utility" of organs or mechanisms; that neither Lamarckian nor Darwinian hypotheses of evolution receive any support from the detailed study of ferns; that there is no correspondence between taxonomy and phylogeny and environment; and that phylogenetic development is the result of an intrinsic

process dependent upon the fundamental organization of the protoplasm[2]—"a sort of 'internal predestination.'"

It is not to be supposed, however, that Prof. Dickason is negative and destructive. On the contrary, having cleared the jungle, he proceeds to lay the foundations for a structure of his own. Using Schaffner's method of "fundamental potentialities," he lays down a ground-plan for ferns—nine characters which the original fern must have possessed, in order to be a fern at all. He discusses some 20 others which may be significant. Eventually he chooses the position of the sori on the veins, whether lateral (I should have said dorsal) or apical, as a primary basis of arrangement. On this basis he divides the ferns of Burma into two series. He disclaims any attempt to place the subdivisions in the order of their evolution, but in general the two series do proceed from families usually regarded as primitive to those considered advanced.

Prof. Dickason remarks that there are soral conditions difficult to interpret; his arrangement would have carried more immediate conviction had he discussed some of these cases. There is, for instance, no obvious reason why *Antrophyum* should be placed with the laterals and *Hemionitis* with the apicals. *Polypodium* appears, without question, among the laterals; but it requires some careful dissection to show that, in the east-American species, the sori are slightly back of the vein-ends, not really terminal. Similarly, the Gymnogrammeae are put, with-

2 This would seem to require some qualification. No one, I suppose, would deny that variations arise from internal causes; but that neither utility nor environment affects the course of their development nor influences Nature's decision as to what shall or shall not survive (and therefore the general phylogenetic picture) is nearly inconceivable. Taken by and large, the critics of Darwin seem to have worked themselves into the position of maintaining that he was wrong in just about everything except his main conclusion. It might not be amiss to remember, now and then, that one of the salient features of Darwinian theory is its innate reasonableness.

out comment, among the apicals, although in such species as *Coniogramme fraxinea* the sporangia normally reach nowhere near the tips of the veins, and in many species poorly developed, short sori are not at the apices of the veins, as one would expect if they originated there, but well below them. Apparently Prof. Dickason has run against some of the difficulties likely to beset any classification based on a single character, and, like Bower with his Marginales and Superficiales, has had to assume phyletic slides.

Incidentally, in making up his series, Dickason has accepted 32 out of 33 of Ching's families segregated from Polypodiaceae. But, though he reproaches Ching for inadequate discussion, he can find no better reason for this acceptance than Ching's own—that it is "in harmony with the present tendency." One can say as much for women's hats.

After such discussion, one feels a sort of yearning for the simplicity and neatness of soral development in Diels's treatment of the Polypodiaceae. One started, in *Woodsia*, with a round sorus, dorsal on the vein and surrounded by an inferior indusium. In *Cystopteris*, the indusium became restricted to the basal side of the sorus. Somewhere along here, a side branch went off which, through *Nephrolepis* and the moving out of the sorus to the leaf-margin, gave rise to the Davallieae. The main line continued to *Dryopteris* and its relatives, with the indusium at the top of the receptacle above the sporangia; through *Athyrium* to *Asplenium*, with the sorus elongate and the indusium becoming lateral, and, by the bending down of the sorus-bearing veins until they were parallel with the midrib, to *Blechnum*. Disappearance of the asplenioid indusium and some lengthening of the sorus gave the gymnogrammoid ferns; moving out of the sorus toward the margin and consequent shortening, the chei-

lanthoid ferns; a lateral spreading of its soriferous veinends, *Pteris;* a rearrangement of the coenosorus to fit different patterns of venation, the Vittarieae. Restriction of the terminal sorus of the Cheilantheae to short lateral veins produced the polypodioid ferns; multiplication of sori, *Cyclophorus;* and a final crowding of the sporangia off the veins on to the leaf-tissue, *Acrostichum.* Any phylogenist will tell you this is too good to be true, and probably he is right; Nature is not so simple. But not every day does one find a fairy-tale which fits so nicely with observed facts.—C. A. WEATHERBY, *Gray Herbarium.*

American Fern Society

EXCHANGE OF FERNS.—The following list of the ferns I now have in cultivation may be of interest to members of the Society. I shall be glad to exchange living plants of tropical or subtropical species or native species of the extreme southern half of the United States or the Pacific Coast. Plants from the northern states will not grow in the climate of Jacksonville. I have had some nice lots from Mr. George Proctor and others, but most of the plants died the first summer and all the rest the second summer, except *Cystopteris fragilis*, which persisted three years. I do not wish herbarium specimens, but I do have on hand some especially fine sheets of *Ophioglossum petiolatum*, as well as some other native species, and I shall be glad to make up specimens of any species in my collection in exchange for living plants.

Acrostichum aureum
Adiantum affine
capillus-veneris
caudatum
cuneatum
diaphanum
formosum
Adiantum gracillimum
hispidulum
macrophyllum
Poiretii (?)
tenerum
trapeziforme
Wagneri

Anchistea virginica
Anemia phyllitidis
rotundifolia
Asplenium Curtissii
heterochroum
platyneuron
plenum
resiliens
subtile
verecundum
Athyrium asplenioides
Blechnum occidentale
serrulatum
Bolbitis heteroclita
quoyana
Botrychium dissectum var.
tenuifolium
Cheilanthes microphylla
Cyclophorus lingua
Cyrtomium caryotideum
falcatum
Davallia fijiensis
fijiensis var. *plumosa*
Dennstaedtia adiantoides
Diplazium esculentum
popayanense
zeylanicum
Drynaria quercifolia
Doodia media
Dryopteris ampla
augescens
dentata
gongylodes
longirhizoma
ludoviciana
normalis
ovata
panamensis
reducta
reptans
serrata
Thelypteris
unca
Isoëtes Engelmannii
Engelmannii var.
caroliniana
flaccida
flaccida var. *alata*
Lorinseria areolata
Lygodium japonicum
Lycopodium carolinianum
prostratum
Marsilea macropoda
Nephrolepis cordifolia
davalloides var.
furcans
ensifolia
exaltata and vars.
Ophioglossum crotalophoroides
petiolatum
Onychium japonicum
Osmunda cinnamomea
regalis
Pellaea falcata
rotundifolia
viridis
Polypodium angustifolium
aureum
Billardieri
Knightii
mandaianum
pectinatum
pennigerum
phymatodes
phyllitidis
plumula
polypodioides
punctatum
tenellum
Platycerium aethiopicum
alcicorne
bifurcatum
Polystichum acrostichoides
adiantiforme
tsus-simense

Pteris latiuscula var. *pseudo-caudata*
Pycnodoria cretica
cretica var. *albo-lineata*
cretica var. *cristata*
longifolia
multifida
multifida var. *cristata*
Psilotum nudum
Selaginella apoda
arenicola
Braunii
Emmeliana
flabellata
haematodes
Kraussiana
Stenochlaena tenuifolia
Tectaria cicutaria
heracleifolia
minima

MRS. W. D. DIDDELL, *8092 Hawthorne St., Jacksonville, Florida.*

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Published by the

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WILLIAM R. MAXON

R. C. BENEDICT C. V. MORTON

IRA L. WIGGINS

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American Fern Journal

VOL. 37 APRIL–JUNE, 1947 NO. 2

Ferns and Fern Allies of Cumberland, Rhode Island

ERNEST J. PALMER

During the war years, while it was difficult to travel far afield, my family and I managed to spend a number of pleasant week-ends at the Diamond Hill State Forest Park in the town of Cumberland, Providence Co., Rhode Island, and while the younger members of the family were amusing themselves with other activities I carried on the project of studying and collecting the local flora. The area that was rather intensively explored on foot lies within a radius of from one and a half to three miles of our central camp at the ski trail shelter near the north end of the high ridge known as Diamond Hill. A few excursions were made beyond this area and a little collecting was done in other parts of the town of Cumberland. Between 800 and 900 species and varieties of vascular plants were found in the Diamond Hill area, and as each trip has added to the list, it seems certain that the number could be considerably increased. The ferns and fern allies number 40, and it is possible that even in this group a few more may eventually be discovered. The assemblage of ferns is a rather large one for so limited an area, and although most of them are common in this part of New England, a few were found that are of considerable interest and the full list may be worth recording.

[Volume 37, No. 1, of the JOURNAL, pages 1–32, was issued March 11, 1947.]

The region is one of the most rugged and diverse to be found in the state of Rhode Island, with a rapidly changing alternation of rocky ridges and ledges, dry rocky woods, open bogs, and swampy woods, and with smaller areas of wet open meadow along the streams and of rich woods bordering some of the swamps. A perennial stream, Miscoe Brook or Crystal Brook, flows from Miscoe Lake on the Massachusetts boundary southward along the western base of the Diamond Hill ridge, and several other streams enter the area. Some small shallow ponds that mostly disappear in dry seasons occupy openings in the woods, and larger lakes and reservoirs have been formed by damming up the streams. Most of the area is wooded with a growth of small deciduous trees and with a small percentage of pines and junipers in places. The rock outcrops consist of quartz, granite, and schist, and more locally of quartzite, slate, and conglomerate. Glacially transported deposits of boulders, gravel, and sand, much of it redistributed by the streams, cover much of the surface. The soils are mostly acid, but certain plants found along ledges near the Pawtucket Reservoir and elsewhere seem to indicate that the residual soils may not be entirely deficient in lime.

Some of the ferns are very abundant and the pteridophytes form a larger and more important part of the herbaceous flora than the number of species would indicate. Of the 26 true ferns, 12 may be said to be very common; 6 are fairly abundant; and 8 are uncommon or rare. Among the fern allies *Equisetum arvense*, *Lycopodium complanatum*, and *L. obscurum* var. *dendroideum* are extremely abundant in many places, while *Equisetum hyemale*, *E. fluviatile*, and *Lycopodium inundatum* were each collected only at a single station.

OPHIOGLOSSACEAE

BOTRYCHIUM VIRGINIANUM L.

Frequent in a number of localities in rich or moist woods.

BOTRYCHIUM DISSECTUM Spreng.

Rare, in moist rich woods.

BOTRYCHIUM DISSECTUM var. OBLIQUUM (Muhl.) Clute

Growing with the last, and somewhat more abundant.

BOTRYCHIUM MATRICARIAEFOLIUM A. Br.

A colony was found on a moist, rich, partially shaded slope, with a few scattered plants extending into the adjoining wet rocky woods. Several dozen plants were seen at this station.

OSMUNDACEAE

OSMUNDA REGALIS L. var. SPECTABILIS (Willd.) Gray

The Royal Fern is abundant throughout the area in wet or boggy ground.

OSMUNDA CLAYTONIANA L.

Common in open swampy woods and in wet open ground.

OSMUNDA CINNAMOMEA L.

Common in wet ground and on the borders of bogs and ponds.

POLYPODIACEAE

WOODSIA OBTUSA (Spreng.) Torr.

Uncommon, but found at a number of stations on rocky, partially shaded ledges.

CYSTOPTERIS FRAGILIS (L.) Bernh.

The Fragile Fern is usually a calciphile or a plant of rich moist woods where the soil is not distinctly acid, and suitable habitats for it are lacking in most of the area. But a few weak plants were discovered along the base of a moist shaded ledge near the Pawtucket Reservoir, and it was found growing vigorously on the walls of a

cellar at an old house site in the northwest part of the town. Here it had become established in some way and had found a favorable environment in the moist shaded crevices of the rocks with their lime mortar filling.

ONOCLEA SENSIBILIS L.

Very common in open swampy ground and in wet woods.

DRYOPTERIS HEXAGONOPTERA (Michx.) C. Chr.

Rather uncommon in rich woods, but colonies were found at several widely scattered stations.

DRYOPTERIS THELYPTERIS (L.) Gray var. PUBESCENS (Laws.) A. R. Prince

Very common in swamps and in wet open woods.

DRYOPTERIS NOVEBORACENSIS (L.) Gray

Very common in moist or rich woods.

DRYOPTERIS MARGINALIS (L.) Gray

Common along rocky ledges and in clefts, especially in quartz outcrops on Diamond Hill.

DRYOPTERIS CRISTATA (L.) Gray

Rather uncommon but generally distributed in open swampy ground.

DRYOPTERIS SPINULOSA (O. F. Muell.) Watt

Rarer and sparingly found in clefts and along ledges of wooded cliffs.

DRYOPTERIS SPINULOSA var. INTERMEDIA (Muhl.) Underw.

With the typical variety. Rare.

POLYSTICHUM ACROSTICHOIDES (Michx.) Schott

Not common, but found in a number of places in rich rocky woods and on moist banks.

DENNSTAEDTIA PUNCTILOBULA (Michx.) Moore

One of the commonest ferns on moderately dry ledges and in open woods, usually in the zone between the dry rocky uplands and the swamps or wet woods.

ATHYRIUM ANGUSTUM (Willd.) Presl var. RUBELLUM (Gilb.) Butters

Common in rich or moist rocky woods.

ATHYRIUM ANGUSTUM var. ELATIUS (Link) Butters

In similar situations to the last, but less common.

ASPLENIUM PLATYNEURON (L.) Oakes

The Ebony Spleenwort was not seen on the quartz outcrops of Diamond Hill, but it is not rare elsewhere along old walls and on ledges of the granite areas.

ASPLENIUM TRICHOMANES L.

Rare and local. A few plants were found at one station near the base of a moist shaded ledge.

ADIANTUM PEDATUM L.

Found sparingly in a few places in rich or moist woods.

PTERIDIUM LATIUSCULUM (Desv.) Hieronymus

Abundant throughout in dry open woods. It is found in the dryest situations of any fern of the region, except perhaps a few of the rock ferns.

POLYPODIUM VIRGINIANUM L.

Often very abundant and in large colonies on rocky slopes and ledges, and especially in the quartz outcrops of Diamond Hill.

EQUISETACEAE

EQUISETUM ARVENSE L.

Common in many places, usually on open banks or in moderately dry open ground.

EQUISETUM PALUSTRE L.

Locally abundant in rocky swampy woods.

EQUISETUM FLUVIATILE L.

A large colony was found growing in open ground on the margin of shallow pools in an old gravel pit.

EQUISETUM SYLVATICUM L.

Locally abundant in wet or moist ground in a few localities.

EQUISETUM HYEMALE L.

Found only in one locality, along the edge of a rocky brook near the head of the Pawtucket Reservoir.

LYCOPODIACEAE

LYCOPODIUM LUCIDULUM Michx.

Not common, but found among rocks in rich or wet open woods.

LYCOPODIUM CLAVATUM L.

Several extensive colonies were found in moist rich woods.

LYCOPODIUM INUNDATUM L.

Apparently rare; found only at one station, on the muddy margin of shallow pools in an abandoned granite quarry.

LYCOPODIUM OBSCURUM L. var. DENDROIDEUM (Michx.) D. C. Eaton

Very common in dry open woods throughout the area.

LYCOPODIUM COMPLANATUM L.

Common and in large colonies in rather dry woods and thickets.

SELAGINELLACEAE

SELAGINELLA APODA (L.) Fern.

Uncommon in moist or wet woods.

ISOËTACEAE

ISOËTES RIPARIA Engelm. var. CANADENSIS Engelm.

In wet sand and gravel of old gravel pit, where submerged in wet times.

ISOËTES ECHINOSPORA Dur.

In mud along the margin of pools and ponds.

ISOËTES ENGELMANNI A. Br.

Partially submerged or on the muddy margin of pools. in an old gravel pit.

ARNOLD ARBORETUM.

A Check-list of the Ferns of Arizona

WALTER S. PHILLIPS

(Conclusion)

NOTHOLAENA NEGLECTA Maxon.

Very rare in the southeastern part of the state on exposed limestone cliffs. COCHISE: Mule Mts., *Goodding* 1362, 1384. Maxon (10) cites *Lemmon* in 1882 from Huachuca Mts.

NOTHOLAENA PARRYI D. C. Eaton.

Dry, exposed, rocky slopes and cliffs in the western half of the state, 1,000 to 4,000 ft. COCONINO: Grand Canyon:[10] Bright Angel Trail, *Thornber* 8236. GILA: Sierra Ancha, Kyle Asbestos Claim, *Little* 4289. MARICOPA: Sierra Estrella, *Kearney et al.* 3276 (S); *Peebles & Smith* 10709 (S). MOHAVE:[11] Burro Creek, *Benson & Darrow* 10901. Meriwitica Canyon, *Whiting* (S). Yucca, *Jones* 4800. PIMA: Tucson Mts., *Humphrey.* PINAL: Sacaton Mts., *Peebles & Harrison* 11 (S); *Thornber* 8185. Slate Mts., *Darrow* 2463. YUMA: Cabeza Prieta Mts., *Benson & Darrow* 10813. Tinajas Altas: *Kearney & Harrison* 6575 (S); *Wiggins; Goodding.* Buckskin Mts., Planet Canyon, *Shreve* 7630. Kofa Mts., Palm Canyon, *Peebles & Loomis* 6789.

NOTHOLAENA SINUATA (Lag.) Kaulf.

Rocky hillsides in the desert grasslands, mainly in the southeastern part of the state, 2,000 to 6,000 ft. For a discussion of this species see Weatherby (27, pp. 313–315). Mr. Weatherby has checked over our material and agrees with my determinations. Maxon (10) does not admit var. *integerrima* to the Arizona flora. The synonymy of the forms and varieties as given by Broun (2) is incorrect. COCHISE: Bowie, *Jones* 4249. Chiricahua Mts., Tex Canyon, *Phillips et al.* 2535. Huachuca Mts.: Carr Canyon, *Phillips et al.* 2548; Montezuma Canyon, *Goodding* 376. COCONINO: Oak Creek, visitor to Museum in 1942 (S). GRAHAM: Pinaleno Mts., Marijilda Canyon, *Moeller & Richardson* 153. PIMA: Ajo Mts., Pitahaya Canyon, *Nichol.* Baboquivari Mts.: Baboquivari Peak, *Darrow* (in habit transitional to var. *integerrima*); Baboquivari Canyon, *Peebles* 604 (S). Coyote Mts., *Phillips* 2616. Rillito Mts., *Johnson.* Rincon Mts., Happy Valley, *Phillips & Pultz* 2727. Santa Catalina Mts.: Pima Canyon, *Griffiths* 2193,

[10] Clover and Jotter cite collections from Deer Creek and Lava Falls also.

[11] Clover and Jotter cite a collection from Spencer Canyon.

2313; *Thornber & Brown* 5230; Bear Canyon, *Thornber et al.* 4413; Pantatoc Canyon, *Phillips* 2279; Sabino Canyon, *Thornber* 316. Santa Rita Mts., Florida Canyon, *Thornber*. Sierrita Mts., *Spalding*. PINAL: Sierra Estrella, *Peebles et al.*.3283 (S). Oracle, *Spruance*. SANTA CRUZ: Patagonia Mts., *Peebles et al.* 5592 (S); *Kearney & Peebles* 14820 (S); Circle Z Ranch, *Streets*. YUMA: Kofa Mts., Tunnel Springs Mine, *McMurray* 1297.

NOTHOLAENA SINUATA var. COCHISENSIS (Goodding) Weatherby.

With the typical variety but more common on limestone outcroppings, 1,000 to 7,000 ft. COCHISE: Chiricahua Mts.: *Blumer* 1522; Hand's Trail, *Blumer* 1530. Dos Cabezas Mts.: *Shreve* 4263; *Phillips et al.* 2517. Huachuca Mts.: *Goodding* 373; Carr Canyon, *Phillips et al.* 2568. Mule Mts., Paul Spur, *Benson* 11122. COCONINO: Grand Canyon, Yaki Trail, *Mead* (G). GILA: Sierra Ancha, Parker Creek, *Little* 4287. Pinal Mts., Devil Canyon, *Loomis* 826 (S). MOHAVE: Meriwitica Canyon, *Whiting* (S). PIMA: Coyote Mts., *Phillips* 2615. Quitobaquito Mts., *Gould et al.* 2418. Sierrita Mts., *Spalding* (seems transitional to var. *integerrima*). Rincon Mts., Colossal Caves, *Darrow* 2138. Santa Catalina Mts.: Sabino Canyon, *Kearney et al.* 1442 (S); Soldier Canyon, *Phillips* 2471 (growing with the typical variety). Tucson Mts.: *Thornber* 2051, 4325, 4504; *Swingle* S66. PINAL: Galiuro Mts., Aravaipa Canyon, *Darrow*. Slate Mts., *Darrow* 2453.

NOTHOLAENA SINUATA var. INTEGERRIMA Hook.

Rare in the southeastern part of the state, usually in rockier places and steeper hillsides than the typical variety. COCHISE: Chiricahua Mts., *Blumer* 1527. Mule Mts., *Goodding* 1396. PINAL: Sacaton Mts., *Peebles et al.* 475 (S). Oracle, *Peebles et al.* 2473 (S). Superior, above Queen Creek, *Whitehead*.

NOTHOLAENA STANDLEYI Maxon.

In crevices of canyon sides and under large boulders of granitic or volcanic rock, 1,000 to 6,000 ft. COCHISE: Bowie, *Jones*. Chiricahua Mts., Tex Canyon, *Phillips et al.* 2534. Dos Cabezas Mts., *Thornber* 7019. Huachuca Mts., Carr Canyon, *Phillips et al.* 2570. Mule Mts., Dixie Canyon, *Goodding* 450. GILA: Sierra Ancha, Parker Creek, *Little* 4198. MARICOPA: Canyon Lake, *Peebles* 10758 (S). Pine Creek, *Kearney et al.* 5226 (S). Sierra Estrella, *Peebles* 6396 (S). PIMA: Ajo Mts.: *Darrow et al.* 2364; Pitahaya Canyon, *Nichol*. Coyote Mts., *Phillips* 2601. Growler Mts., *Darrow et al.* 2428. Puerto Blanco Mts., Dripping Springs, *Darrow*

et al. 2441. Quitobaquito Mts., *Darrow et al.* 2421. Santa Catalina Mts.: Bear Canyon, *Thornber* 4415; Pantatoc Canyon, *Phillips* 2281; Pima Canyon, *Griffiths* 2175; Sabino Canyon, *Thornber* 319; Soldier Canyon, *Phillips* 2272. Tucson Mts., *Thornber* 4324, 4424. PINAL: Sacaton Mts., *Kearney et al.* 490. Maxon (10) lists Graham, Greenlee, and Santa Cruz Counties also.

OPHIOGLOSSUM ENGELMANNII Prantl.

Rare in the southeastern part of the state in low, wet areas, usually around water holes, but occasionally producing large numbers of plants when cattle are not present, 4,000 ft. COCHISE: Hereford, *Harrison* 8267 (S). Clausen (4) cites collections from the Huachuca Mts. (*Lemmon*) and the Mustang Mts. (*Pringle*).

OPHIOGLOSSUM VULGATUM L.

A single collection, by Lemmon from the Huachuca Mts., Cochise Co., is cited by Clausen (4).

PELLAEA ATROPURPUREA (L.) Link.

Steep canyon walls in shade, usually on limestone but occasionally on igneous rocks below limestone, 3,500 to 6,500 ft. COCHISE: Bowie, *Jones*. Chiricahua Mts.: *Loomis & Peebles* 5416 (S); Heart of Rocks, *Clark* 9200 (C). Huachuca Mts.: *Kearney et al.* 3442 (S); Carr Canyon, *Phillips et al.* 2558; Cave Creek Canyon, *Phillips* 2799; Ramsey Canyon, *Goodding* 1330, 1355; *Peebles et al.* 3501 (S); *Darrow* 2592b. COCONINO: Havasu Canyon, *Whiting* (N). GILA: Sierra Ancha, Parker Creek Canyon, *Little* 4044. GRAHAM: Pinaleno Mts.: *Thornber & Shreve* 8031; Frye Canyon, *Shreve* 4350. PIMA: Baboquivari Mts., Baboquivari Canyon, *Peebles & Harrison* 3961 (S). Santa Catalina Mts.: Mt. Lemmon, *Lemmon*; Bear Canyon, *Thornber* 5707. Santa Rita Mts., Florida Canyon, *Thornber*. Rincon Mts., Happy Valley, Sycamore Creek, *Phillips & Pultz* 2755a. SANTA CRUZ: Oro Blanco Mts., Sycamore Canyon, *Darrow & Haskell* 2238. Santa Rita Mts., Madera Canyon, *Peebles et al.* 1352 (S). Maxon (10) lists Navajo County.

PELLAEA INTERMEDIA Mett.

Shaded rocky slopes in rich soil in crevices of limestone rock, 3,500 to 7,000 ft. COCHISE: Chiricahua Mts.: Hand's Trail, *Blumer* 1528; Echo Canyon, *Clark* 8441 (C). Huachuca Mts., Ramsey Canyon, *Goodding* 1356. Mule Mts., *Goodding* 1388. GILA: Mazatzal Mts., Reno Pass, *Peebles & Smith* 11572 (S). Sierra Ancha, Parker Creek, *Little* 4212. PIMA: Baboquivari Mts.:

Baboquivari Canyon, *Harrison & Swift* 7736 (S); South Canyon, *Peebles et al.* 3832 (S). Santa Catalina Mts.: Pima Canyon, *Griffiths* 2186; Marble Peak, *Darrow*. SANTA CRUZ: Oro Blanco Mts., Sycamore Canyon, *Benson* 10958.

PELLAEA LONGIMUCRONATA Hook.

Among boulders on talus slopes and rocky hillsides of igneous rocks, in extremely dry places, 2,000 to 6,000 ft. COCHISE: Bowie, *Jones* 4807. Chiricahua Mts.: Cave Creek, *Phillips et al.* 2528; Rucker Canyon, *Phillips & Darrow* 2784; White Tail Canyon, *Clark* 8342. Dragoon Mts., *Griffiths* 1874. Mule Mts., *Goodding* 977. COCONINO: Oak Creek Canyon, *Whiting*. Grand Canyon: Bright Angel Trail, *Thornber* 8234; *Darrow*. GILA: Sierra Ancha, Parker Creek, *Little* 4199. Payson, *Smith*. GRAHAM: Galiuro Mts., High Creek, *Phillips & Pultz* 1816, 1855. Fort Grant, *Goodding* 1052. Pinaleno Mts., Wet Canyon, *Phillips et al.* 2512, 2513. MARICOPA: Fish Creek, *Peebles et al.* 5252 (S). Mormon Flats, *Loomis* 1006. MOHAVE: Grand Wash Cliffs, *Whiting* (N). Hualpai Mt., *Kearney & Peebles* 11262 (S). Oatman-Kingman Road, *Harrison et al.* 7609 (S). PIMA: Ajo Mts.: Alamos Canyon, *Nichol;* Pitahaya Canyon, *Nichol.* Baboquivari Mts.: Baboquivari Canyon, *Harrison & Swift* 7735 (S); *Peebles et al.* 333 (S); South Canyon, *Peebles et al.* 3828 (S). Coyote Mts., *Phillips* 2593. Puerto Blanco Mts., Dripping Springs, *Darrow et al.* 2439. Rincon Mts., Happy Valley, *Phillips & Pultz* 2723. Santa Catalina Mts.: Bear Canyon, *Thornber et al.* 4416; Pantatoc Canyon, *Phillips* 2282. Pima Canyon, *Griffiths* 2125; Sabino Canyon, *Thornber* 5228; Soldier Canyon, *Shreve* 5115; *Phillips* 2474. Santa Rita Mts., Florida Canyon, *Peebles et al.* 1374 (S); *Thornber*. Tucson Mts., *Thornber*. PINAL: Oracle, *Thornber*. SANTA CRUZ: Santa Rita Mts., Madera Canyon, *D.M.* in 1928. YUMA: Kofa Mts., *McMurray* 1293.

PELLAEA SUKSDORFIANA Butters.

Very rare in northern Arizona, 6,500 to 9,000 ft. COCONINO: Grand Canyon, Long Jim Canyon, *Collom* (G). Butters (3) cites *Korstain & Baker* from Jacobs Lake, Kaibab Forest, and *MacDougal* from San Francisco Mts.

PELLAEA TERNIFOLIA (Cav.) Link.

Rocky canyon walls in moist crevices, usually near limestone or water charged with limestone, 5,000 to 7,000 ft. Sometimes growing near *Pellaea atropurpurea* and other times near *P. wrightiana.*

COCHISE: Huachuca Mts.: Ramsey Canyon, *Goodding* 766; *Darrow* 2592a; Tungsten Reef Mine, *Phillips et al.* 2565. SANTA CRUZ: Patagonia Mts., Hawshaw Creek, *Phillips* 2793. The relationship of *P. ternifolia* to *P. wrightiana* in the Arizona specimens is not clear.

PELLAEA WRIGHTIANA Hook.

Often growing with *P. longimucronata,* but mostly in moister situations nearer streams and in rocky washes, 4,000 to 8,000 ft. COCHISE: Chiricahua Mts.: Balanced Rock, *Clark* 8442; Barfoot Peak, *Blumer* 1867; Bonita Canyon, *Clark* 8268 (C); Cave Creek, *Phillips et al.* 2529; Hunt Canyon, *Clark* 8588. Huachuca Mts.: Carr Canyon, *Phillips et al.* 2541; Tungsten Reef Mine, *Phillips et al.* 2562, 2563. Mule Mts., *Goodding* 472. COCONINO: Elden Mt., *Bradey* (N). GILA: Sierra Ancha, Parker Creek, *Little* 4214. GRAHAM: Galiuro Mts., High Creek, *Pultz & Phillips* 1856, 1857; Pinaleno Mts., Swift Trail, *Peebles* 14526 (S). PIMA: Santa Catalina Mts.: Mount Bigelow, *Phillips* 2397; Mount Lemmon, *Lemmon;* Pima Canyon, *Thornber & Brown;* Sabino Canyon, *Thornber* 4146, 5641; Soldier Canyon, *Thornber* 5767. Rincon Mts., *Phillips & Pultz* 2722, 2724, 2732. PINAL: Superior-Miami Highway, *Peebles et al.* 3216. Maxon (10) lists Santa Cruz County also. Broun (2) omits this species from his Index.

PHANEROPHLEBIA AURICULATA Underw.

Steep, moist canyon walls in deep crevices, often near or under waterfalls of spring seeps, 2,000 to 7,000 ft. COCHISE: Chiricahua Mts.: *Loomis & Peebles* 5413 (S); Picket Canyon, *Clark* 8949 (C). Huachuca Mts., Carr Canyon, *Phillips et al.* 2556. PIMA: Baboquivari Mts.: Baboquivari Canyon, *Leding* 592 (S); Baboquivari Peak, *Gould et al.* 2788; Brown's Canyon, *Shreve* 5434. SANTA CRUZ: Oro Blanco Mts., Sycamore Canyon, *Kearney & Peebles* 14485 (S); *Benson* 10947.

PITYROGRAMMA TRIANGULARIS var. MAXONII Weatherby.

Shaded, rocky canyons, ledges, and under edges of large boulders of igneous rock in southeastern Arizona, 2,000 to 5,000 ft. GILA: Sierra Ancha, Parker Creek, *Little* 4222. GRAHAM: Pinaleno Mts.: Frye Canyon, *Shreve* 4362; Sawmill, *Thornber & Shreve* 7797. MARICOPA: Sierra Estrella, *Peebles et al.* 3294 (S). PIMA: Ajo Mts.: *Nichol;* Alamo Canyon, *Tinkham;* Pitahaya Canyon, *Nichol.* Baboquivari Mts.: Baboquivari Peak, *Darrow;* Baboquivari Canyon, *Peebles et al.* 334, 3957 (S); Cave Canyon, *Thackery* 68; Mendoza Canyon, *Phillips* 2760; South Canyon, *Harrison & Swift*

7727 (S). Coyote Mts., *Phillips* 2602, 2609. Santa Catalina Mts.: Pantatoc Canyon, *Phillips* 2278; Pima Canyon, *Thornber* 4341, 5232; *Shreve* 5142; Sabino Canyon, *Kearney & Peebles* 10313 (S). Rincon Mts., Rincon Valley, *Blumer* 3271. PINAL: Galiuro Mts., Holy Joe Peak, *Darrow*.

POLYPODIUM THYSSANOLEPIS A. Br.

Local in southern Arizona, usually under overhanging rock ledges, 5,000 to 6,000 ft. COCHISE: Chiricahua Mts., *Loomis & Peebles* 5415 (S). Huachuca Mts.: *Lemmon;* Ramsey Canyon, *Goodding* 761; *Peebles et al.* 3509 (S); *Darrow* 2594. Maxon (10) lists Baboquivari Mts., in Pima County.

POLYPODIUM HESPERIUM Maxon.

Crevices of steep canyon walls and ledges in forested areas, 7,000 to 9,000 ft. COCHISE: Huachuca Mts., Miller Canyon, *Goodding* 123. COCONINO: Oak Creek, *Wetherill.* Mogollon Rim at Dude Lake, *Phillips* 2847. GILA: Sierra Ancha, Baker Mt., *Harrison* 7879 (S). GRAHAM: Pinaleno Mts.: Fort Grant, *Goodding* 1046; Marijilda Canyon, *Phillips et al.* 2484, 2483. PIMA: Baboquivari Mts., Baboquivari Peak, *Darrow.* Santa Catalina Mts.: Mt. Lemmon, *Kearney et al.* 8082 (S); Sabino Canyon, *Phillips* 2376; Soldier Camp, *Phillips* 2309. Rincon Mts., Spud Rock, *Blumer* 3439. This is a very variable species as found in Arizona. Broun (2) calls it *P. vulgare* var. *hesperium*, as perhaps it should be. The varieties *pygmaeum* and *perpusillum* discussed by Fernald (7) are probably merely ecological variants.

POLYSTICHUM LONCHITIS (L.) Roth.

In deep, shaded woods on steep canyon sides in rich soil, 8,000 ft. GRAHAM: Pinaleno Mts.: Frye Canyon above sawmill, *Thornber & Shreve* 7767; Marijilda Canyon, *Phillips et al.* 2482.

POLYSTICHUM SCOPULINUM (D. C. Eaton) Maxon.

COCONINO: Elden Mt., 8,400 ft., *Collins* 14 (F); *Lefebure* 859.

PTERIDIUM AQUILINUM var. PUBESCENS Underw.

Common in the Western Yellow Pine forests, where it often covers the forest floor, 5,000 to 8,000 ft. COCHISE: Chiricahua Mts.: Barfoot Park, *Blumer* 1450; Cave Creek, *Peebles* 5871 (S); Sara Deming Canyon, *Clark* 8141. Huachuca Mts., Miller Canyon, *Goodding* 170.[12] COCONINO: San Francisco Mts.: *Deaver;* Schultz

[12] Tryon (25) says this is intermediate between this variety and var. *latiusculum*.

Pass, *Whiting* (N). Oak Creek, *Wetherill* (N); *Whiting & Sanders.* GRAHAM: Galiuro Mts., High Creek, *Pultz & Phillips* 1851. Pinaleno Mts.: Frye Canyon, *Thornber & Shreve* 7817; Mt. Graham, *Hope & Duncan* 9988 (S). GREENLEE: White Mts., Black River, *Goodding* 632. NAVAJO: McNary Junction, *Pultz* 1722. PIMA: Santa Catalina Mts.: *Anderson* 43; Marshall Gulch, *Shreve* 5897; Mt. Lemmon, *Peebles & Harrison* 2168 (S); Soldier Camp, *Livingston & Thornber.* PINAL: Pinal Mts., *Graham.*

SELAGINELLA ARIZONICA Maxon.

Rocky foothills of southeastern Arizona, often growing in mats with *S. rupincola,* 2,000 to 4,500 ft. GILA: Sierra Ancha, Parker Creek, *Little* 4196. Roosevelt Dam, *Goodding* 722. PIMA: Coyote Mts., *Phillips* 2604. Santa Catalina Mts.: Campbell Ave. Foothills, *Phillips* 2584; Pima Canyon, *Thornber;* Soldier Canyon, *Shreve.* Tucson Mts., *Thornber; Phillips* 2588. PINAL: Sacaton Mts., *Peebles et al.* 480 (S). Maxon (10) lists Graham, Maricopa, and Yuma Counties also, but the record from Yuma Co. is erroneous, having been based on a specimen reidentified by Mr. Weatherby as *S. eremophila.*

SELAGINELLA EREMOPHILA Maxon.

. YUMA: Weatherby (28) cites a collection by Jaeger in 1934 from 40 miles southeast of Yuma, near Tinajas Altas, Yuma County.

SELAGINELLA MUTICA D. C. Eaton.

Damp ledges and cliffs, mostly in northern Arizona, 6,000 to 7,000 ft. COCONINO: Grand Canyon: Bright Angel Trail, *Thornber* 8259; *Eastwood;* Grand View Trail, *Thornber* 8494. Hualpai Canyon, *Clover* 7108. NAVAJO: Sagie Canyon, *Vorhies.* Betatakin Canyon, *Wetherill* 536. Maxon (10) cites a collection by Toumey in 1894 from the Chiricahua Mts., of Cochise County.

SELAGINELLA NEOMEXICANA Maxon.

COCHISE: Maxon (10) cites a collection by Ferriss in 1904 from Paradise.

SELAGINELLA RUPINCOLA Underw.

Rocky hillsides and canyon sides in dry situations in southeastern Arizona, 3,000 to 6,000 ft.; this is the commonest species of the genus in the state. COCHISE: Dragoon Mts., *Griffiths* 2059. Mule Mts., *Goodding* 469. PIMA: Santa Catalina Mts.: Pantatoc Can-

yon, *Phillips* 2280; Sabino Canyon, *Shreve* 5334 (mixed with *S. arizonica*); *Thornber* 315,[13] 5226; Soldier Canyon, *Phillips* 2273; *Phillips et al.* 2473. Santa Rita Mts., Florida Canyon, *Benson* 11037. Rincon Mts., Happy Valley, Ash Creek, *Phillips & Pultz* 2711, 2719, 2720; Rincon Valley, *Blumer* 3266. SANTA CRUZ: Patagonia Mts.: *Peebles et al.* 4657 (S); Flux Canyon, *Benson* 11507.

SELAGINELLA UNDERWOODII Hieron.

Shaded areas in canyons and steep slopes of wooded areas, in rocky soil, 5,000 to 8,000 fet. COCHISE: Chiricahua Mts.: Totem Pole Canyon, *Clark* 8968 (C); Rucker Canyon, *Phillips & Darrow* 2771. COCONINO: Grand Canyon: Kanabonits Canyon, *Collom* 1581; Kaibab Basin, *Collom* 1850. "Cliff Dwellings," *Aubinean* 25. Mogollon Rim, Dude Lake, *Phillips* 2848. PIMA: Soldier Canyon, *Benson* 11391.

SELAGINELLA UNDERWOODII var. DOLICHOTRICHA Weatherby.

Mostly from the southeastern part of the state, where it grows with the typical variety. Where the two grow close together, the typical variety is usually nearer moisture and the var. *dolichotricha* higher on the slopes of the stream. COCHISE: Chiricahua Mts., Rucker Canyon, *Phillips & Darrow* 2781. Huachuca Mts., *Goodding* 213.[14] PIMA: Rincon Mts., Happy Valley, *Phillips & Pultz* 2749; *Phillips* 2866. For a discussion of the variety see Weatherby (29).

WOODSIA MEXICANA Fée.

Rocky ledges and rock outcropping in the Western Yellow Pine forests, 3,500 to 9,000 ft.; at the lower altitudes it is found under rock ledges of streamsides. COCHISE: Bowie, *Jones.* Chiricahua Mts.: Cave Creek, *Harrison et al.* 6201 (S); *Phillips et al.* 2524; Nunt Canyon, *Clark* 8591 (C); Rucker Canyon, *Phillips* 2854; *Phillips et al.* 2537. Huachuca Mts.: *Lemmon;* Carr Canyon, Reef Mine, *Phillips et al.* 2551, 2552, 2553, 2554; Garden Canyon, *Peebles et al.* 3443 (S); Ramsey Canyon, *Shreve* 5028; Tungsten Reef Mine, *Phillips et al.* 2567; Wickerscheim's Cabin, *Goodding* 359. COCONINO: Grand Canyon, Bright Angel Trail, *Thornber*

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[13] This number was pictured by Maxon (17) in his original description of *S. arizonica*, but the three University of Arizona sheets are *S. rupincola.*

[14] Weatherby says of this collection "intermediate with the typical variety."

8537; *Collom* (G). Elden Mt., *Bradey* (N). Flagstaff, *Whiting* (N). Mogollon Rim, Alder Lake, *Phillips* 2850. GILA: Sierra Ancha: Parker Creek, *Little* 4042; Pueblo Canyon, *Harrison* 7886 (S). GRAHAM: Galiuro Mts., High Creek, *Pultz & Phillips* 1830. Pinaleno Mts., Marijilda Canyon, *Phillips et al.* 2485. GREENLEE: Stray Horse Camp, *Phillips* 2809. PIMA: Baboquivari Mts., Toros Canyon, *Peebles, Harrison, & Kearney* 3800 (S).[15] Santa Catalina Mts.: Butterfly Peak, *Phillips* 2313; Lemmon Lookout, *Phillips* 2459; Mt. Lemmon, *Harrison et al.* 8072, 8093 (S); Palisade Ranger Station, *Phillips* 2409; Sabino Canyon, *Phillips* 2441; Soldier Camp, *Phillips* 2310. Rincon Mts., *Goodding* 25; Manning Camp, *Blumer* 3463. SANTA CRUZ: Santa Rita Mts.: Madera Canyon, *Phillips & Reynolds* 2283, 2285. Patagonia Mts., *Peebles et al.* 5601 (S). YAVAPAI: Prescott, *King & Loomis* 7262 (S). A variable species even in the same colony of plants.

WOODSIA OREGANA D. C. Eaton.

Dry cliffs and rocky slopes in the Western Yellow Pine belt of northern Arizona, 5,500 to 11,500 ft. COCONINO: Grand Canyon: Tip Over Spring, *Collom* (S); Kaibab Basin, *Collom* (G); Robber's Roost, *Collom*. Maxon (10) lists San Francisco Mts., and Navajo Mt. in addition.

WOODSIA PLUMMERAE Lemmon.

Rocky ledges and cliffs in the Western Yellow Pine forests, 2,000 to 9,000 ft.; at the lower altitudes it may be found under rock ledges along streams. In characters and range this species seems to intergrade with *W. mexicana*, and the two are sometimes difficult to separate. APACHE: White Mts., Big Lake, *Phillips* 2824, 2825. COCHISE: Huachuca Mts.: *Lemmon* (S); Carr Canyon, *Phillips et al.* 2561. COCONINO: Elden Mt., *Whiting & Bradey* (N). Red Mt., *Phillips* 2843, 2844. Sitgreaves Mt., *Wetherill* (N). GILA: Pinal Mts., *Phillips* 2742. GRAHAM: Pinaleno Mts., *Thornber & Shreve* 7918; *Shreve* 4383. PIMA: Baboquivari Mts., *Darrow*. Santa Catalina Mts.: Butterfly Peak, *Phillips* 2431; Mt. Bigelow, *Phillips* 2396. Soldier Canyon, *Thornber* 7180; *Shreve*. Rincon Mts.: *Harrison et al.* 7977 (S); Happy Valley, *Phillips & Pultz* 2718, 2729, 2865. PINAL: Galiuro Mts., Holy Joe Peak, *Darrow*. YAVAPAI: Prescott, *Harrison* 3998 (S). Maxon (10) lists Santa Cruz and Yuma Counties.

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[15] This specimen seems to be intermediate between *W. mexicana* and *W. plummerae*.

WOODSIA SCOPULINA D. C. Eaton.

COCHISE: Huachuca Mts., *Lemmon* in 1882.[16] Maxon (10) cites a Maricopa Co. collection by Pringle in 1882.

WOODWARDIA FIMBRIATA J. E. Smith.

Canyon bottoms, along streams and about springy places in rich soil, 5,300 to 7,200 ft. GILA: Mazatzal Mts., *Harrison et al.* 7838 (S). GRAHAM: Pinaleno Mts. in 1903, collector not stated. Maxon (10) lists Apache, Cochise, and Pima Counties.

DOUBTFUL OR EXCLUDED SPECIES

ADIANTUM JORDANII Müll. is sometimes listed from Arizona, but no definite specimens or citations have been seen.

ASPLENIUM ABSCISSUM Willd. (*A. firmum* Kunze) has been listed from Arizona, but this is surely an error.

ASPLENIUM VESPERTINUM Maxon has not been noted in any of the Arizona collections.

AZOLLA CAROLINIANA Willd. is an eastern species according to Svenson (22) and is not found in Arizona.

AZOLLA MEXICANA Presl, according to Svenson (22), is known from Utah, Nevada, California and Mexico and thus can be looked for in Arizona.

CHEILANTHES HORRIDULA Maxon is frequently cited from Arizona, apparently on the basis of the original description which cited "head of San Pedro River, Arizona." The head of this river is in Sonora, Mexico, and not on the eastern slopes of the Santa Catalina Mts., as described.

CHEILANTHES MICROPHYLLA Swartz seems to be erroneously reported from Arizona and no specimens from the state have been encountered in the various collections.

CHEILANTHES MYRIOPHYLLA Desv. occurs in the literature and on herbarium labels with Arizona localities. However, Maxon (15) in revising this group does not admit *C. myriophylla* to our flora. The ferns that were formerly placed here are distributed among several species.

CRYPTOGRAMMA CRISPA var. ACROSTICHOIDES (R.Br.) C. B. Clarke may yet be found on some of the higher mountain ranges of northern Arizona but no specimens have been seen.

DRYOPTERIS MEXICANA (Presl) Kuntze, reported from the Huachuca Mts. of Cochise County, is *D. patula* var. *rossii* C. Chr. C. V.

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[16] Maxon has noted on this sheet "this location is highly doubtful."

Morton says, "There is a sheet in the U. S. National Herbarium from the Huachuca Mts. labelled *Aspidium karwinskyanum* and someone has written on the sheet "an *A. mexicanum?*" This is perhaps the source of the record for this species in Arizona.

DRYOPTERIS PATENS (Swartz) Kuntze, reported from Arizona, is *D. feei* C. Chr.

NOTHOLAENA CANDIDA (Mart. & Gal.) Hook. and N. CRETACEA Liebm. often cited from Arizona are referable to *N. californica* D. C. Eaton and *N. neglecta* Maxon according to Maxon (13).

NOTHOLAENA DEALBATA (Pursh) Kunze and N. NIVEA Desv. formerly cited from Arizona are *N. limitanea* Maxon and the variety according to Maxon (16).

NOTHOLAENA FENDLERI Kunze is probably erroneously recorded from Arizona according to Morton (20).

NOTHOLAENA TENERA Gillies from Arizona is *N. jonesii* Maxon, according to Maxon (14).

OPHIOGLOSSUM PUSILLUM Nutt. and OPHIOGLOSSUM NUDICAULE L.f. according to Clausen (4) are not to be admitted to the Arizona flora.

PELLAEA ANDROMEDAEFOLIA (Kaulf.) Fée is not represented in Arizona herbaria by actual specimens. A number of sheets thus labelled are *P. intermedia* Mett.

PELLAEA BREWERI D. C. Eaton is not now known from Arizona but may be looked for on some of the higher mountain ranges of northern Arizona.

PELLAEA MICROPHYLLA Mett. has been reported from Arizona under the same circumstances as *Cheilanthes horridula* given above.

PELLAEA MUCRONATA D. C. Eaton is not represented in Arizona herbaria by actual specimens, but some sheets of *P. longimucronata* and *P. wrightiana* have been labelled *P. mucronata.*

PELLAEA OVATA (Desv.) Weatherby does not seem to occur in Arizona. This name was found on some sheets of *P. intermedia.*

SELAGINELLA LEPIDOPHYLLA (Hook. & Grev.) Spring. has been occasionally listed from Arizona but no actual specimens were seen in the various state herbaria.

The writer wishes to thank C. A. Weatherby, W. R. Maxon and C. V. Morton for aid in identification of various difficult groups. Mr. Morton looked up many of the doubtfully recorded species and sent notes on them. Mr. A. Lefebure and the various fern students in Arizona aided materially in getting this list together.

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UNIVERSITY OF ARIZONA.

Marsilea macropoda in Cultivation

MARY W. DIDDELL

Several years ago Mr. Robert Runyon sent me some plants of *Marsilea macropoda* from the region of Brownsville, Texas. From all the literature on the genus I could find the plants were presumably aquatic, so I planted them in the pool, where they promptly died. Later Mr. Runyon sent me more plants, which I set out in a shallow receptacle without drainage; they lived, but were not particularly enthusiastic about it.

I moved to a place on the River, and in the section devoted to my fern garden set out the *Marsilea*, in a low spot which I dug out some more. This seemed exactly suited to the plants and they began to spread rapidly.

On one side of the hollow rising to higher ground was a long slope, which I terraced with native lime-rock, planting among the rocks *Anemia adiantifolia*, the rock spleenworts, *Pteris cretica*, *P. multifida*, and several species of *Adiantum*. On the other side of the hollow there was very little slope, so I simply walled it in with rocks, planting among them *Dryopteris augescens* and *Selaginella ludoviciana*. Beyond this was the walkway, with the hardest, dryest soil in the entire area. Through the walkway, which was fairly wide, I set flagstones and tried to grow *Selaginella Kraussiana* around and between them, but the ground was so hard and dry that it refused to grow. On the other side of the walkway was a large liveoak, about the base of which were numerous Calatheas and aroids, as well as an assortment of ferns, including a mass of *Diplazium esculentum*.

Soon the Diplaziums began to appear in the walkway, and though I tried to keep them weeded out except at the edges of the rocks they crossed over and went down into the hollow. The Marsileas climbed over the line of rocks among the *Dryopteris* and *Selaginella* and began to spread over the dry walkway, so that in two years' time the hollow was full of *Diplazium*, with very little *Marsilea*, and the walkway was so completely carpeted with *Marsilea* that it was necessary periodically to dig the flagstones out from under it. I examined the Marsileas from time to time, but although they spread widely over the dry area by branching freely, they have never produced any sporocarps.

JACKSONVILLE, FLORIDA.

Taxonomy of a Dryopteris Hybrid

CLYDE F. REED

Recently, Dr. Joseph Ewan described a new hybrid *Dryopteris Filix-mas* × *D. oreopteris*.[1] In looking over some Czechoslovakian publications in my library I find that Dr. Karel Domin had previously published a hybrid between these two species, based on material from "Subcarpathian" Russia.[2]

A further study of Dr. Ewan's material from British Columbia is desirable because of the doubts expressed—"there was no sign of *D. Filix-mas* anywhere," and "the form of the lobes and the position of the sori approach *D. oreopteris*. I have not seen a sufficient series of *D. oreopteris* from the Old World to determine the North American var. *hesperia* (Slosson) Broun and its distinctness. The variation among the North American individuals is certainly very great." Further doubt is shown by the use of the words "putative hybrid."

The position of the sori is said to be similar to that in *D. oreopteris;* but although the indusium is described, no mention is made of the spores. The spores of *D. oreopteris* are unique among the northern North American members of the Dryopteris-complex by their long prickly exospores; the indusium is quite small, with the cell-walls wavy (but not so tortuous as in *D. Filix-mas*); the annulus is 14–16-celled, in specimens from British Columbia (*Butters* 931 in the Gray Herbarium). *Dryopteris Filix-mas* has smaller spores, with a wavy exospore; the cells of the indusium have tortuous walls; and the annulus is 13- or 14-celled, in specimens from Newfoundland. If the type material of Dr. Ewan's hybrid (*Lohbrunner &*

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[1] Amer. Fern Journ. 34: 115. 1944.

[2] "Contribution à la connaissance des Ptéridophytes de Russie Subcarpathique," Věda Přírodní 1929: 277–281. 1929.

Nichols 9555) is fertile, a study of the spores, indusia, and annuli is quite necessary in placing this plant more accurately. Whether the hybrid is fertile or sterile can also be determined by the spores.

BALTIMORE, MARYLAND.

American Fern Society

Report of the President for 1946

The year 1946 was an eventful one for the Society. I know it was for the officers and I believe the members will be interested in a brief story of the developments.

For some ten years past the Society has had headquarters at the Brooklyn Botanic Garden under an agreement which either party could terminate at a year's notice. Last spring the Director of the Garden informed us that he wished to end this arrangement, and about mid-year Dr. Svenson, our long-time and efficient Treasurer, transferred from the Brooklyn Botanic Garden to the American Museum of Natural History, New York. In his new position Dr. Svenson felt that he could not carry on the Treasurer's work. While at the Garden he had had the help of Mr. William Durkin, the Herbarium assistant, a skilled and careful bookkeeper. An even more onerous position filled by Dr. Svenson, also with Dr. Durkin's assistance, has been essentially that of business manager of the Fern Journal, a task long carried by Mr. E. J. Winslow as a separate assignment. Miss Hester M. Rusk, another staff member, has given conscientious service to the Society as Curator of the Herbarium and Librarian. After Dr. Svenson's departure Mr. Durkin continued the routine work under Dr. Svenson's supervision, but this arrangement could, of course, be only temporary.

The Nominating Committee, responsible for nominating the Treasurer along with the other officers, under the chairmanship of Dr. Benedict, who was untiring in his efforts, gave the matter long and careful study. Dr. Svenson agreed to continue his supervision until a successor could be found, and was accordingly renominated and elected. The Garden kindly agreed to continue the clerical and other help until new plans were made, with the understanding that the Society would make a contribution of $200 to the Garden towards its expenses; this was so ordered by the Executive Council. That the burden of this payment might not rest too heavily on our treasury several members have made contributions to the amount of $125.00. Others who are moved to do likewise may send a check to the Treasurer; such gifts will be gladly received.

Following the election of officers for 1947 a committee composed of Mr. Ewan, Dr. Benedict, and Mr. Morton was appointed to develop plans for the future. After investigating various possibilities the committee recommended that Mr. Walter S. Allen, of Flushing, New York, be appointed Treasurer to fill the position vacated by Dr. Svenson. Mr. Allen, a member of long standing, is familiar with the Society's finances, since he has audited our books for a number of years. The Society is indeed fortunate in having Mr. Allen's services. The committee recommended also that Dr. R. M. Tryon, Jr., be appointed Librarian and Curator of the Herbarium, and that the library and herbarium be transferred to the University of Minnesota. This is being done, and both books and specimens will continue to be available for loan to all members of the Society. The appointments of Mr. Allen and Dr. Tryon have been approved by the Executive Council. Finally, the committee was able to

obtain storage space for back numbers of the Journal with the Smithsonian Institution, in Washington, where they will be in charge of Mr. Morton. The laborious task of transfer has been completed, and we are indeed grateful to the Institution for this very great accommodation.

Dr. Svenson took over the Treasurer's office when our financial affairs were at low ebb and in ten years has carried us to a high degree of solvency. Now he and Miss Rusk will see three highly trained persons carry on with the tasks which they have done so well in past years. We are indeed fortunate in our new officials. Let us give them our full backing.

Mrs. Whitney is furnishing a report of the meeting held during the holidays in Boston, which was one of the best attended and most interesting meetings the Society has ever held. Let me add a word concerning the continuous and very helpful work of our Secretary. She has been and is a guide and advisor to all the officers and I gladly testify to her helpfulness.

The members of the Society will be gratified to know that our honored Editor, Dr. Maxon, who has not been too well since his retirement from active duty at the Smithsonian Institution, is now in better health. Many of the members gave themselves the pleasure of sending him messages for his seventieth birthday, February 27. which gave him pleasure also. Mr. Morton, who has been associated with Dr. Maxon in the editing of the Journal. has helped also in the administration of the Society's affairs.

In closing this report I need say a word in sincere appreciation to the many members who have written me of their interest in the Society and their wish to be of help. The many invitations to visit them and to see their prize exhibits of interesting fern gardens and woodland stations have been greatly appreciated, and I hope in

time to see many of these good people and their interesting plants. I have shared many of these letters with other officers and they too have enjoyed these evidences of the deep interest of persons here and there all over the country. It was an interesting year. All's well that ends well, and the new year has begun very well indeed.

FREDERICK L. FAGLEY, *President*

Report of the Secretary for 1946

During this first full year following the end of war activities your Society has been rapidly getting back to normal, seemingly with a stimulated interest in fern studies by many of the members.

It is gratifying to report that about 60 new members were enrolled during the year. This was fully double the number of those lost for all reasons, and leaves the total membership at the end of 1946 at 411. The Life Members now number 17.

Death claimed Dr. Robert A. Harper, a member since the early days of 1913, who since his retirement from Columbia University had lived at Bedford, Virginia; also R. M. Kriebel, of the Experiment Station at Purdue University, and G. M. Soxman, of Dallas, Texas, members since 1933 and 1935, respectively.

It is interesting to note that a considerable number of our new members come from the far western states. Shall we attribute this trend to a new awakening of interest in their native surroundings on the part of native westerners, or to an influx into the area of mid-westerners who find beyond the mountains a much richer fern flora than the mid-west afforded? Or perhaps a wide interest in strange floras, stimulated by the world-roaming of war participants, is holding over as a lasting hobby for some who decided that the west coast area has so much to offer that they have chosen to settle down there. For what-

ever reason, we welcome them to membership, and look forward to interesting reports of local fern studies and the finding of range extensions.

In response to President Fagley's suggestion that members might well make records of fern stations within local areas, one New York State member has sent the Secretary a large-scale map of her area with fern stations carefully indicated. More such maps, or sections of topographic sheets, might be filed with the Curator of our Herbarium, provided the location of rare species is not so detailed as to expose them to extermination by "collectors."

Respectfully submitted,
ELSIE G. WHITNEY, *Secretary*

Report of the Treasurer for 1946

[The following report was compiled by Dr. Svenson prior to his retirement from the Treasurer's post at the beginning of 1947. We would call attention to five new Life Memberships, to the sale of $217.83 worth of back numbers of the Fern Journal, and to the fact that total receipts were close to those of 1945—excluding the bequest of $1000 received in the latter year. The Society's total assets are within a few dollars of the amount at the close of 1945.—WALTER S. ALLEN.]

Receipts	*Amount*	*Sub-total*	*Total*
Cash on hand Jan. 1, 1946			$ 477.47
Cash withdrawn from Bissell Herbarium Fund			8.88
1942 Membership Arrears	$ 1.50	$ 1.50	
1943 Membership Arrears	3.00	3.00	
1944 Membership Arrears	6.00	6.00	
1945 Membership Arrears	13.50	13.50	
1946 Membership Renewals	374.50		
1946 New Members	54.00	428.50	
1947 Membership Renewals	20.90		
1947 New Members	18.00	38.90	
1948 Membership Renewals	2.00	2.00	
1941 Subscription Arrears	1.35	1.35	

1942 Subscription Arrears	2.60	2.60	
1943 Subscription Arrears	2.60	2.60	
1944 Subscription Arrears	2.60	2.60	
1945 Subscription Arrears	3.85	3.85	
1946 Subscription Renewals	72.54		
1946 New Subscribers	22.88	95.42	
1947 Subscription Renewals	73.41		
1947 New Subscribers	3.85	77.26	
1948 Subscription Renewals	2.50	2.50	
Life Membership	125.00	125.00	
Sale of back numbers A.F.J.	217.83	217.83	
Sale of A.F.J. Cumulative Index	1.00	1.00	
Sale of "Vars. and Forms of Ferns of E. No. Am."	1.00	1.00	
Sale of 1 book (A.F.S. Library)	4.00	4.00	
Gift			
Not restricted	15.00	15.00	
1946 Advertising	4.00	4.00	
Reprints	53.87	53.87	
			$1,103.28
			$1,589.63
Deduction a/c Life Membership[a]	125.00		
Deduction a/c Profit on Sales A.F.J.[b]	54.31		
Deduction a/c Sales Discount A.F.J.[c]	24.64		
Deduction a/c 1947 Subscription[d]	1.25		
Deduction a/c Agency Commission (subscribers)[e]	12.42		
Deduction a/c Bank Charges (1946 Memb.)[f]	.90		
Deduction a/c Bank Charges (1946 Subscr.)[g]	.34		
Deduction a/c Bank Charges—Sale of back numbers A.F.J.[h]	.10		$ 218.96
			$1,370.67

[a] Transferred to Spec. Acct. No. 2.
[b] Transferred to Reserve Fund.
[c] Deducted at source of sale.
[d] Held for collection by Brooklyn Trust Co.
[e] Deducted at source of subscription.
[f] Deducted by bank at time of deposit.
[g] Deducted by bank at time of deposit.
[h] Deducted by bank at time of deposit.

Disbursements	*Amount*	*Sub-total*	*Total*
Science Press			
A.F.J. Vol. 35, no. 4	$213.75		
A.F.J. Vol. 36, no. 1	146.77		
A.F.J. Vol. 36, no. 2	143.90		
A.F.J. Vol. 36, no. 3	186.28	$690.70	
1200 printed clasp envelopes	11.10	11.10	
200 Reprints—Constitution—A.F.S.	9.04	9.04	
Reprints	53.87	53.87	

Bank Charges (service and activity) ...	9.91	9.91	
Postage			
Sales A.F.J.	8.21	8.21	
Expense			
Treasurer	22.02	22.02	
Secretary 1945	26.78		
1946	28.50	55.28	
Editor	6.64	6.64	
Librarian	10.00	10.00	
Curator	8.88	8.88	
Brooklyn Botanic Garden	200.00	200.00	$1,085.65
Cash on hand Jan. 1, 1947			$ 285.02

STATEMENT, DECEMBER 31, 1946

Assets			*Liabilities*	
Cash on hand	$ 285.02		Capital Acct.	$2225.81
In Spec. Acct. No. 1	507.58		Suspense Cr.	
In Spec. Acct. No. 2	260.64		1947 Memb. ...	40.40
In Reserve Fund	1389.11	$2442.35	1948 Memb. ...	2.00
Notes Receivable		1.00	1947 Subscr. ..	76.01
Inventory A.F.J.		459.85	1948 Subscr. ..	2.50
A.F.S. Library		336.70	Gift	15.00
Accts. Receivable ...		36.67	A.F.S. Library	4.00
Suspense Dr.			Distrib. Vol. 36, no. 4 ...	150.00
1947 Agency Com.		7.24	Bissell Herb. Fund	507.58
1948 Agency Com.		.13	Life Memb. Fund	260.64
		$3283.94		$3283.94

Respectfully submitted,

HENRY K. SVENSON, *Treasurer*

Report of the Auditing Committee

The undersigned have checked all the receipts and expenditures of the American Fern Society for 1946 and find the Treasurer's statement correct.

We find the finances of the Society in a satisfactory condition and desire to commend Dr. Svenson and his staff for their very careful work.

WALTER S. ALLEN

ARTHUR H. GRAVES

Auditing Committee

Report of the Judge of Elections

In the recent balloting for officers of the American Fern Society for 1947, 117 ballots were returned, of which three were invalid. The results were as follows:

For President	
Dr. Frederick L. Fagley	111
Dr. E. T. Wherry	1
Dr. Robert T. Clausen	1
Dr. R. M. Tryon, Jr.	1
For Vice-President	
Mr. Joseph Ewan	110
Dr. E. T. Wherry	1
Dr. R. C. Benedict	1
Mrs. Frank C. Smith	1
For Secretary	
Mrs. Elsie G. Whitney	112
Mr. George R. Proctor	1
Mr. Harold G. Rugg	1
For Treasurer	
Dr. Henry K. Svenson	111
Mr. Walter S. Allen	2

I therefore declare the following candidates elected to the several offices: President, Dr. Frederick L. Fagley; Vice-President, Mr. Joseph Ewan; Secretary, Mrs. Elsie G. Whitney; Treasurer, Dr. Henry K. Svenson.

HAROLD G. RUGG, *Judge of Elections*

The Boston Meeting of the Society

The winter program meeting of the Society was held in conjunction with the week's Convocation of the American Association for the Advancement of Science at Boston, Mass. On Saturday morning, December 28th, thirty or more members and friends gathered at nine o'clock at the Lenox Hotel to listen to, learn from, and join in the discussion of, the papers presented. In the absence of President Fagley, Vice-President Ewan presided.

Dr. Mildred Faust brought up to date the careful studies and census-takings of the Hart's-tongue Fern in

Central New York. The general increase in the number of individual plants, and of newly found sites, indicates prosperity for the fern—unless visited by some major catastrophe. Dr. Faust and her co-workers seem to have a very personal acquaintance with each individual plant!

Constant characteristic differences in the prothallus stages in some of the species of *Notholaena,* particularly in the presence of glands, were clearly described and beautifully illustrated by Mrs. Alice F. Tryon.

Dr. R. M. Tryon, Jr., with a series of dotted maps thrown on the screen, showed the geographical distribution of many of the ferns of Minnesota and neighboring areas of Wisconsin. The Society should expect much and profit greatly from the team work in fern studies of these two youthful members.

Mr. Richard Harlow was not able to be present to show us pictures of his New England fern garden, but his place on the program was filled by Dr. Edgar T. Wherry, who told us, with colored slides, of recent extensions in the geographical ranges of some eastern ferns. He commented also on the application of the name *Cheilanthes lanosa.*

It was like a mystery story, and quite as exciting, to hear Mr. Ewan tell of his discovery of the Andean ferns collected by Prof. James Orton, of Vassar College, in the 1860's. The clues had to be pieced together to establish the correct identity of the specimens, because the sheets lacked the customary labels and bore only a few telling words, such as "Antisana."

From his long knowledge of ferns and fern students, Mr. C. A. Weatherby told us something of the personal side of Davenport, Dodge, and other early fern students of New England, most of whom carried on fern studies as a spare-time avocation in addition to a full and busy "job" along other lines. From this talk we felt that,

even though we had not been actually associating with these people, we had at least been allowed a very intimate glimpse of their personalities.

The lively discussion that followed this program was indicative of how greatly it interested everyone; and the opportunity to get a speaking acquaintance with other members of the Society made us all wish that such meetings might be held oftener.

ELSIE G. WHITNEY, *Secretary*

Mr. James Neeman, c/o Wizard Nursery, Fortuna, California, wishes to exchange living plants of ferns of the eastern and southeastern states. He desires dwarf species only, those not exceeding 12 inches in height. In exchange he can send plants of the following western species: *Adiantum Capillus-Veneris, A. Jordanii, A. pedatum* var. *aleuticum, Asplenium vespertinum, Blechnum spicant, Cheilanthes californica, C. Clevelandii, C. siliquosa, Dryopteris oregana, Notholaena californica, N. Newberryi, N. Parryi, Pellaea andromedifolia, P. mucronata, Pityrogramma triangularis* and var. *viscosa, Polypodium Scouleri, Polystichum californicum, P. Dudleyi, P. munitum,* and *Woodwardia fimbriata.*

Dr. Edgar T. Wherry advises us that the second edition of his "Guide to Eastern Ferns" is out of print, so far as the publishers' stock is concerned. A few copies are still available at the Academy of Natural Sciences of Philadelphia, but these are only sold over the counter and mail orders can not be accepted.

NEW MEMBERS

Mr. William H. Baker, 434 No. 29th St., Corvallis, Oregon.
Dr. Sullivan Bedell, 1618 Perry St., Jacksonville, Florida.
Dr. Stephen Jay Berko, 305 Camp Ave., Braddock, Pennsylvania.
Miss Florence Branum, 117 No. Ewing St., Lancaster, Ohio.
Mrs. Haydn L. Brown, Main St., Atkinson, New Hampshire.

Mr. A. H. Edmondson, R. F. D. 1, Forestville, Upper Marlboro, Md.
Mrs. John Zell Gaston, 2210 Riverside Drive, Houston 4, Texas.
Mr. Robert James Loeffler, 119 Broad St., Syracuse, New York.
Mr. Gladstone W. McDowell, 435 Woodward Way, N. W., Atlanta, Georgia.
Mr. Claude C. Miller, Box 455, 40 Manor Road, Fairfax, California.
Mr. James Neeman, c/o Wizard Nursery, Fortuna, California.
Mr. W. L. Oldham, 1043 South Weaver St., Springfield, Missouri.
Mr. Roy Proctor, 1139 La Brea Ave., Inglewood, California.
Mrs. Alice F. Tryon, Department of Botany, University of Minnesota, Minneapolis 14, Minnesota.
Dr. C. M. Van De Water, 82 Essex Road, Summit, New Jersey.
Mrs. H. F. Woodley, 3206 Greenfield Ave., Los Angeles 34, Calif.

CHANGES OF ADDRESS

Mr. Donald M. Britton, Miller School of Biology, University of Virginia, Charlottesville, Virginia.
Mrs. Elsie W. Cisler, 1020 Poplar St., Missoula, Montana.
Mr. William Bridge Cooke, 1718A Pullman St., Pullman, Wash.
Mrs. Anita J. Cotner, 1019 Court St., Howesdale, Pennsylvania.
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Published by the

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EDITORS

WILLIAM R. MAXON

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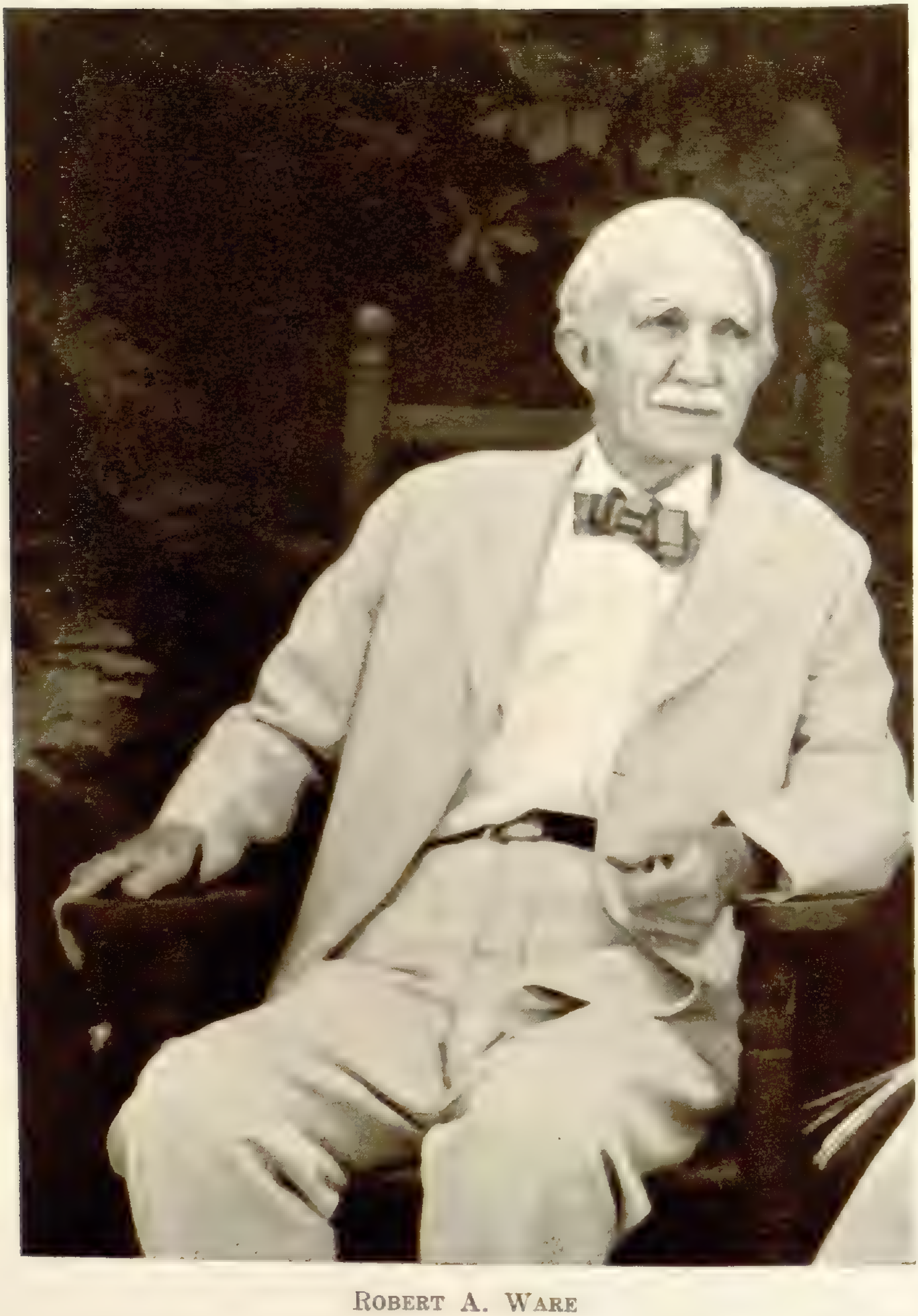

Robert A. Ware

American Fern Journal

VOL. 37 JULY–SEPTEMBER, 1947 NO. 3

Robert A. Ware

C. A. WEATHERBY

Robert Allison Ware, a member of the Fern Society since 1903 and its president in 1912 and 1913, died at Boston, November 16, 1946.

Mr. Ware was born in Boston, April 14, 1857. His parents soon moved to North Wrentham, Massachusetts. now Norfolk, the ancestral home of the Ware family; he was brought up there. In his early twenties he returned to Boston and entered the employ of Carter, Rice & Co., paper dealers, with whom he remained during the whole of a long business career, retiring about 1928. He married, first Bertha Louise Wiggin, who died in 1893, and, some years later, Charlotte Clement Barrell. He then purchased the homestead in Norfolk which had been in the possession of his family since 1661. There most of his summers in the latter part of his life were spent, at first in the house, later in a cabin in one of the Ware fields, with a fine grove of white pines nearby. Those of us who knew him in his later years like to remember him in those surroundings and in the gracious old house in Boston, at the corner of famed Louisburg Square, which he acquired shortly before his retirement from business.

Mr. Ware had many interests. He was an accomplished musician, singing in church choirs and with choral societies and in company with his first wife, who was a skilful pianist. About 1921 he became interested in the projection of lantern slides and for a long time was in considerable demand as a professional operator

[Volume 37, No. 2, of the JOURNAL, pages 33–64, was issued July 8, 1947.]

at lectures. But his principal outside interest was in botany. During many vacations in New England and adjacent regions and on journeys in Europe and California he collected extensively, on the longer expeditions confining himself to pteridophytes, both because of a special liking for them and because specimens of them were relatively easy to prepare with the limited time and equipment of an individual traveller. He got together a considerable herbarium and had planned to undertake botanical work with it after his retirement. But the depression of the 1930's compelled a contraction of his living space; there was no longer room for the herbarium, and it was sold to Smith College, where it now is. There are many duplicates in the Gray Herbarium and that of the New England Botanical Club.

Mr. Ware was an early member of that club and active in it. He was its vice-president from 1914 to 1917 and for 15 years, as chairman of the program committee, in charge of its meetings. In the Fern Society he was president in a somewhat critical time, when the new Fern Journal was getting firmly on its feet.[1] Then, in a revision of the constitution, in a later drive for new members, and at the time of the then treasurer's misappropriation of funds, Mr. Ware's good judgment, business experience, and tact were put freely and very usefully at the service of the Society.

Mr. Ware was "a pleasant and lovable person," with a friendly and attractive personality and a keen appreciation of all that was good in life. The following vivid and poetical account of an experience which all collectors have had may stand as typical of him: ". . . having indulged myself somewhat freely in the matter of pteridо-

[1] It is a characteristic prank of the "printer's devil" that a page on which Ware, in a letter to the members, remarked that the Journal was "splendidly edited and well printed," should have this as caption: "Ware: Letter to thf members."

phytes, I find a delight in them which is quite apart from any scientific interest attaching to them. As with a 'wishing carpet' I have but to review them to be wafted over seas and mountains and forests and landed in charming valleys and by running brooks. I can see again the very picture—smell again the very odors of the fields and forests where I walked, generally quite alone. What a wealth there is in such records!"[2]

Studio Fern Photography

CHARLES NEIDORF

No recent discussion of procedures for photographing ferns indoors appears to exist. As a matter of fact, the only prior discussion the writer is aware of is to be found in Waters' "Ferns," published in 1903. What few instructions Waters gives are by and large as applicable today as they ever were, but a more up-to-date discussion seems advisable. As an amateur photographer the writer makes no claim that the methods herein described, based as they are strictly on personal experience, are necessarily the best or the only ones applicable. Comments from others who may have done similar work are invited.

EQUIPMENT

CAMERA.—A 4×5 view camera, with its long bellows extension and ground-glass focusing, is practically standard equipment for this sort of work.

LENSES.—In addition to a general-purpose anastigmat of normal focal length for this size camera (6 or 7 inches) a short focal-length lens will be required, if close-up views are to be made. For moderate close-ups the writer uses a $3\frac{1}{2}$-inch lens and for extreme close-ups a 40-mm. miniature camera lens. (Incidentally, it may be of

[2] From a letter to B. L. Robinson, dated May 25, 1917.

interest to anyone thinking of buying equipment in these times of scarcity and high prices to point out that neither of these short focal-length lenses has a shutter; exposures are made by turning the light on and off. Quite reasonably priced enlarging lenses without shutters are available which are very well suited for this type of work.)

LIGHTING EQUIPMENT.—Two photoflood lamps in reflectors on collapsible stands should be considered basic. In addition, some device (a bright-dim switch) for cutting down the intensity of the light at all times except when the actual exposure is being made will be found useful in materially extending the life of the bulbs, which used at full intensity have a life of only six hours; doing all preliminary focusing with the lights at half-brightness also cuts down the intense heat-radiation and thus helps to avoid, or at any rate postpone, the danger of wilting the specimen. For close-up work the writer prefers to work with a 500-watt focusing spotlight, but this is rather expensive.

TECHNIQUE

1. KEEPING SPECIMENS FRESH.—One of the advantages of working indoors is that specimens need not be photographed immediately after they are found. Placed in a vasculum lined with moist newspaper, sprinkled lightly, and covered with another layer of moist newspaper, they may be kept fresh for well over a week if put in a cold place; even at room temperature they will keep perfectly for several days.

2. CHOICE OF POSITION.—The most frequently used and certainly the simplest arrangement is to have the specimen lying horizontally. Owing to the inevitable tendency of the upper end of most fronds to droop over, they do not lend themselves readily to a vertical arrangement. On the other hand, this does not mean that a

vertical arrangement is to be avoided at all times. Quite the contrary; the writer considers that some of the very best photographs he has ever made were of vertical specimens. (See Plate 3.)

The set-ups used need not be elaborate. For horizontal specimens a wooden box will do as a support, books, magazines or other flat objects being piled up to add height. Vertical specimens are clamped in a vise attached to the edge of a table or desk.

3. BACKGROUND.—Two factors must be considered—color and distance from the object. For vertical specimens the writer prefers to use a black background (a large sheet of cardboard or plywood painted flat black) placed far enough behind the specimen to avoid cast shadows. White or gray backgrounds may also be used, but in most instances have been found to be not nearly so effective, though worth experimenting with.

For horizontal specimens a greater variety of arrangements is possible. The most frequently used set-up is to have the specimen resting on a white background, such as a sheet of herbarium mounting paper, taking care that the surface texture is not so rough that the single-lamp low-angle lighting which is frequently necessary causes it to stand out too prominently (particularly in close-up views), nor so highly calendered as to introduce glare effects.

Shadows cast on the white background by the specimen are a problem. While not invariably objectionable and, in fact, on special occasions even necessary, their elimination will undoubtedly improve most photographs; but this is not easily accomplished. What is required is something very similar to a contact printer: a large box fitted with one or more light-bulbs, a sheet of clear glass on top, and, on a shelf an inch or two below this, a sheet of opal or ground glass to diffuse the light evenly. Pro-

POLYSTICHUM ACROSTICHOIDES F. GRAVESII CLUTE

vided the intensity of the light from this box is properly matched with that from the main lights, cast shadows will be eliminated.

To obtain a satisfactory black background with a horizontal specimen involves resorting to a somewhat elaborate expedient, but the results achieved are well worth the extra effort. Simply placing the specimen on a sheet of black paper will not do; the surface texture of the paper invariably shows up, so that the background is never a deep, uniform black. Instead, the specimen should be placed on a large sheet of clear glass supported at either end at the proper level. The black background (the sheet of cardboard or plywood previously mentioned) should then be placed *on the floor* directly underneath an opaque screen of some sort so arranged as to cast a shadow on it, thus preventing extraneous light from striking and accentuating any shiny spots which may be present. (Incidentally, such opaque screens should similarly be used with the vertical set-up.) One difficulty with this method is that the glass must be scrupulously clean; extremely small objects, such as dust-particles, or bits of scales or sporangia from the specimen, if brightly lit against a dark background, will show up very prominently. White or gray backgrounds similarly placed on the floor may also be tried, but again it must be reported that they have not been found nearly so effective.

4. KEEPING SPECIMEN FLAT.—To overcome the tendency of fronds clamped upright to droop, the writer makes use of a piece of black thread stretched between supports on either side of the specimen and pulled either forward or backward against the upper end of the specimen until the desired vertical alignment is obtained. On the other hand, it may be advisable to take advantage of positions other than the strictly vertical. By tilting

either the specimen or the camera it is sometimes possible to achieve striking perspective views which would otherwise be obscured.

In a horizontal set-up many ferns, especially the larger ones, have a natural tendency to lie reasonably flat (though after confinement in a vasculum for any length of time this may no longer hold true). For comparatively long-distance views, such as those showing entire herbarium sheets, no manipulation of any kind may be required. Closer views, however, are another story. As the distance between lens and object decreases, depth of field also decreases; consequently if all portions of the area selected are to be equally sharp, measures must be taken to insure flatness of field. Moreover, not much deviation from a single plane is required to cause pinnae turned slightly on edge to cast long, ugly shadows. To overcome these difficulties all that may be required is to place small weights along the rachis on either side of that portion to be included in the photograph. But more often the only solution is to cover the entire specimen with a sheet of glass or, as Waters suggests, actually glue the specimen to the support.

The use of a flattening sheet of glass, although it introduces several complicating factors, is perhaps simpler than gluing the specimen. It goes without saying that the glass must be scrupulously clean, particularly if the frond is to be arranged against a black background. Precautions must be taken to avoid condensation of moisture on it from the specimen. When removed from the vasculum the frond is patted lightly between folds of a towel, the glass is warmed by holding it near the hot lights, and—most important—the set-up is reexamined carefully several times, to make certain that there is no moisture condensation as time goes by. Precautions must also be taken to avoid glaring reflections of either

the lights or camera lens from the surface of the glass, but this is a simple enough matter of observing the image on the ground glass. And finally, it is best to avoid a total flattening of the specimen. A thick rachis will, of course, make such a total flattening impossible; but there are instances when a single pinna alone is used (e.g., for close-up views of sori), in which case it is advisable to slip thin objects, such as pieces of cardboard, on either side of the frond between the glass and the support to avoid crushing the indusia. An extremely slight separation may be all that is required, but it should not be overlooked.

5. LIGHTING.—Waters used natural light only, and it is obvious from the results he obtained that there is much to be said in its favor. The writer can not speak from personal experience in this matter, however, having used artificial light exclusively. Whichever lighting system is used, it is safe to state that no other factor is so important in determining the success of a photograph, no other requires so much attention or takes up so great a proportion of the total time involved, and about no other factor is it so difficult to give detailed, specific instructions.

Comparatively long-distance views (entire herbarium sheets) require standard 45° lighting, one photoflood on either side of the camera. Results are likely to be rather lacking in detail and, if the specimen is not flat enough, there may be objectionable double shadows. For such large subjects flat lighting is almost unavoidable, however, because of the limitations of the inverse square law; if only a single lamp is used, one side will be much more brightly lit than the other. It is best, therefore, to avoid full views of large fronds. Much better results will be obtained with set-ups which permit the use of a single low-angle, texture-revealing light, with or without a dis-

Dryopteris marginalis (L.) Gray

tant fill-in light to prevent dense black shadows, that is to say, with close-up views. Here too the lighting will be somewhat uneven, though not nearly to such an extent as with large subjects, and much can be done to correct this defect by judicious dodging when the enlargement is made.

Two precautions should be noted. First, the lights, which become very hot, must not be placed too close to the specimen. The danger of moisture condensation has been noted in connection with horizontal glass-covered fronds; with vertical specimens the intense heat-radiation is likely to cause the unsupported pinnae actually to quiver, ruining definition. Secondly, great care must be taken to prevent stray light from shining into the lens, especially when the lens is close to a white background, which acts as an efficient reflector. In such cases, with the bellows extended to almost 20 inches, the angle of view is so narrow that the writer has found it feasible to use an extra-long cylindrical tube as a lens shade, a far more efficient one, it should be pointed out, than any normally encountered.

OBJECTIVES

Indoor fern photography is preeminently suitable for record or other scientific purposes. The extremely sharp rendition of detail which is obtainable under favorable conditions makes studio methods unsurpassed, if not indispensable, whenever the problem arises of emphasizing any of the characteristic minute structures and textures (i.e., details of pinna-cutting, venation, reproductive organs, pubescence, or indument) which are regarded as diagnostic features in every genus, every species, and every subspecific variant. Photographs taken primarily for their aesthetic appeal are no doubt less frequent, but are certainly not to be overlooked. On the other hand,

it would seem that pictorial quality is a far more important consideration in most fern photographs taken in the field—of necessity, one might add. Whatever "practical" or scientific value such outdoor photographs have lies, undoubtedly, in the accurate representation of habit features—fronds erect, spreading, drooping, etc.—and of significant ecological relationships. Obviously both types of fern photography have their place.

ADVANTAGES

When one considers the many advantages there are to working in the studio rather than in the field, it is hard to understand why more fern photographs are not made indoors.

1. FREEDOM FROM MOTION DUE TO BREEZES.—Out-of-doors such motion often forces the photographer to use a wide lens aperture plus a high shutter speed, thus sacrificing depth of field and making it impossible to obtain over-all sharpness.

2. CONTROLLED LIGHTING.—In the field sunlight is likely to be either too dull at the particular time and in the particular place where a desirable specimen is found (as in deep woods) or else so glaringly strong that harsh contrasts, with dense black shadows, are unavoidable, unless special equipment, such as screens or reflectors or even flash lighting, is used. Indoors it is not necessary to wait two hours for favorable lighting conditions, as was the (not unusual) case with the field photographer Dr. Fagley[1] mentions.

3. FREEDOM FROM DISTRACTING BACKGROUND.—This problem, one of the greatest bugaboos of field photography, is, quite simply, nonexistent indoors.

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[1] Fagley, F. L. 1946. A Word to Amateur Members. Amer. Fern Journ. 36: 29–31.

4. FREEDOM FROM LIMITATIONS IMPOSED BY TERRAIN.—Indoors the photographer is not at the mercy of the terrain, compelled to select a viewpoint and perspective he does not like (as in photographing a small, low-growing fern), just because his tripod will not permit him to get close enough to the specimen or get down low enough, and he is unwilling, or finds it impracticable, to hold the camera in his hand. Nor does he have to contend simultaneously with midday summer heat, high humidity, or annoying insects—though it must be conceded that photography indoors is not without its own set of annoyances and gremlins.

5. FREEDOM OF CHOICE OF EQUIPMENT.—Indoors the equipment can be as large and as sturdy as the photographer can afford—and within reason the larger and sturdier the equipment the better the results will be; whereas in the field the photographer is limited to what he can carry along with some degree of comfort, which almost invariably means one of the smaller cameras (and not much else).

127 CANNON ST., NEW YORK 2, N. Y.

Our Easternmost Cheilanthes Species

EDGAR T. WHERRY

In Rhodora **48**: 383, 1946, Prof. M. L. Fernald considers Michaux's "*Nephrodium lanosum*" to represent not, as usually held, *Cheilanthes vestita* (Spreng.) Swartz, but instead *C. tomentosa* Link. The basis for this is the claim that *C. vestita* has "hispid or hirsute (not tomentose or lanate) fronds," whereas in *C. tomentosa* they are "extremely lanate."

Actually, when one sees these plants growing intermixed in the field, the similarity of their indument is striking; so closely do they resemble one another that it is practically impossible to avoid making a mixed collec-

tion.[1] Only when a hand lens or binocular is brought into play can a separation be made, and this is based not so much on indument as on lamina subdivision.

Professor Fernald has more "faith in the accuracy of André Michaux" than pteridologists seem likely to have, in view of his assignment to the single genus *Nephrodium* of entities with the most diverse types of sori. However, in this case Michaux was sufficiently accurate to make plain what entity he had at hand: its cutting was "bipinnatifida," and ultimate lobes "subrotundo-ovalibus." Both characterizations apply to *C. vestita*, not to *C. tomentosa*, for in the latter the cutting is tripinnatifid and the ultimate lobes are obovate. The descriptions by other workers quoted by Fernald also fit *C. vestita* the better.

There is preserved at Kew a letter dated March 6, 1862, written by D. C. Eaton to Sir William Hooker, a copy of which, obtained by Dr. Maxon many years ago, has been lent me by Mr. Morton of the U. S. National Herbarium. It shows that in their day both Asa Gray and Eaton were looking into the identity of Michaux's plant. Eaton writes:

"Some time ago Dr. Gray sent specimens of what I call *Cheilanthes lanuginosa* Nuttall and of *Ch. vestita* Sw. to M. Ch. Naudin of the French Academy, for comparison with the original specimens of Michaux. The answer was: 'J'ai consulté l'herbier de Michaux, et je trouve, *a n'en pas douter*, que le moins velue des deux est le *Nephrodium lanosum* Michx. Flr. Bor. Am. tom. II, p. 270.' That is to say,—*Neph. lanosum* Mx. = the Pennsylvania and Carolina plant that I consider to be

---

[1] Only last September, Mr. George R. Proctor, who was not acquainted with these ferns in the field, went with me to a point in eastern Tennessee, where I had seen them growing many years before. He found that they could not be readily distinguished where they grew on the shale ledges, and came down with an admixture of the two.

Cheil. vestita Sw. . . . The references to *Neph. lanosum* in Gray's Manual and in my ferns of Mex. Bound. of course are now wholly wrong. . . ."

All the evidence points, then, to "*Nephrodium lanosum*" having been the entity otherwise known as *Cheilanthes vestita*. Since the sole basis for doubting this is an inferred misapplication of a descriptive adjective, for which inference field experience yields no support, pteridologists may well retain in their current sense the epithets involved.

UNIVERSITY OF PENNSYLVANIA.

Survey of Ferns in a Maine Mountain Area

H. H. HAZEN

For the past 20 years a survey of ferns has been under way in a peninsula, about one mile long and a quarter of a mile in width, situated near Rangeley, Maine. This latitude is almost exactly 45° and the longitude 70.8°. The elevation is approximately 1,400 feet and the surrounding area is mountainous and heavily wooded. The precipitation varies from 36 to 40 inches annually. The maximum temperature in summer is 90°, although the thermometer rarely goes above 87° and then for only a few days. Snow in winter is heavy and frosts may occur as early as August 25, and as late as June 10. Well over 100 years ago this peninsula was swept by fire, which burned off most of the top soil, leaving rock ledges exposed, but the area is still heavily wooded, the prevailing trees being spruce, fir, and white birch. The soil is decidedly acid, as shown by the prevalence of acid-loving plants, such as the bunch-berry (*Cornus canadensis*).

Up to the present time the following ferns have been found growing upon this territory:

POLYPODY (*Polypodium vulgare*). There are only a few rocky ledges where this fern occurs, but here it is very profuse.

BRACKEN (*Pteridium latiusculum*). This grows freely by the side of the road and in a cow pasture.

SILVERY SPLEENWORT (*Athyrium thelypteroides*). Fairly common.

LADY-FERN (*Athyrium angustum*). Found frequently, often mixed with the Silvery Spleenwort.

WALKING FERN (*Camptosorus rhizophyllus*). Found but once, and then not on rocks but on a rather marshy beach, just above high water mark.

MARSH-FERN (*Dryopteris Thelypteris*). Around the edges of the lake, sometimes in colonies and sometimes as solitary specimens.

MASSACHUSETTS FERN (*Dryopteris simulata*). Not found until the summer of 1946, when two plants were discovered in a large fern box, growing with the New York fern. As the other ferns in this box had been planted, it is difficult to say just how they managed to reach this location.

NEW YORK FERN (*Dryopteris noveboracensis*). This species was hunted for a number of years, apparently not very intelligently, and it was finally decided to purchase some. A favorable site was selected, the ferns were planted, and then it was almost immediately discovered that the site chosen for planting was within a few feet of a flourishing colony. Later many solitary specimens were discovered, usually in rather dry areas.

NARROW BEECH-FERN (*Dryopteris Phegopteris*). Very common.

WINGED BEECH-FERN (*Dryopteris hexagonoptera*). Rare, only two specimens having been discovered.

OAK-FERN (*Dryopteris disjuncta*). This is always found in colonies in moist, rocky woods.

BOOTT'S WOOD-FERN (*Dryopteris Boottii*). Found but once.

CRESTED WOOD-FERN (*Dryopteris cristata*). Often seen, but always as single plants.

COMMON WOOD-FERN (*Dryopteris intermedia*). Abundant throughout the woods.

MOUNTAIN WOOD-FERN (*Dryopteris dilatata*). Very common.

BRITTLE FERN (*Cystopteris fragilis*). Found usually in rather open, rocky ground.

COMMON WOODSIA (*Woodsia obtusa*). Common.

HAY-SCENTED FERN (*Dennstaedtia punctilobula*). So common as to be a nuisance to the gardener, except when wanted for a bouquet.

SENSITIVE FERN (*Onoclea sensibilis*). Common.

OSTRICH FERN (*Pteretis nodulosa*). Common only at one end of the peninsula, where it is contiguous with the mainland; not found elsewhere.

INTERRUPTED FERN (*Osmunda Claytoniana*). Common.

CINNAMON FERN (*Osmunda cinnamomea*). Common.

MATRICARY GRAPE-FERN (*Botrychium matricariaefolium*). Found but once, growing in grass near margin of the lake.

LEATHERY GRAPE-FERN (*Botrychium multifidum*). Found repeatedly in grass, a few feet from the edge of the lake. Its height varies from 12 to 18 inches. This and the last are identified by Dr. Clausen from photographs.

In addition to the ferns found on this strip of ground, others occur within a few miles. These are:

MAIDENHAIR (*Adiantum pedatum*). Apparently rare in this section of the country; only one colony known to occur.

MAIDENHAIR SPLEENWORT (*Asplenium Trichomanes*). Rarely found. This seems strange, for the fern grows splendidly with me.

RUSTY WOODSIA (*Woodsia ilvensis*). In open fields, growing on rocks.

ROYAL FERN (*Osmunda regalis*). In great profusion in numerous areas.

I have attempted to grow a number of other ferns that should be indigenous to this area, and all have done at least fairly well, some remarkably well. They are:

Purple Cliff-brake (*Pellaea atropurpurea*) has done only fairly well; one year all my plants died, and they rarely come to life before the first of July.

Ebony Spleenwort (*Asplenium platyneuron*) usually appears about the middle of July, never earlier.

Narrowleaf Spleenwort (*Athyrium pycnocarpon*) has done beautifully, spreading in the face of considerable competition.

Christmas Fern (*Polystichum acrostichoides*) has done well, but requires more protection from the sun than it does around Washington, D. C.

Braun's Holly-fern (*Polystichum Braunii*) has done well, but has not multiplied.

Leather Wood-fern (*Dryopteris marginalis*) has spread considerably.

Male-fern (*Dryopteris Filix-mas*) grows to a large size, but so far has not spread.

Goldie's Fern (*Dryopteris Goldiana*) has acted in the same manner as the Male-fern.

Clinton Wood-fern (*Dryopteris Clintoniana*) has grown and spread well.

Berry Bladder-fern (*Cystopteris bulbifera*) grows beautifully.

WASHINGTON, D. C.

A Forked Form of the Broad Beech-fern

CLYDE F. REED

Since its crested[1] form was found in 1944 along the Gunpowder River, in Baltimore County, Maryland, the author has spent considerable time noting differences in the external morphology of the Broad Beech-fern. Recently, another noteworthy form has come to light, in which the lateral pinnae of the fertile fronds all, or practically all, fork about two or three centimeters from their apices. The portions of the pinna above the fork often overlap each other. A few dozen plants were observed, and some were collected, in open ravines near Peach Bottom, Lancaster County, Pennsylvania, August 4, 1946. Several colonies within a few hundred yards were found, and three of these had fertile fronds with forked lateral pinnae. The sterile fronds are quite small, about 10 cm. in width and 13 cm. in length, and though of rather crisp texture have a "wilted" appearance. There was definitely plenty of moisture, as well as plenty of sunlight, so that the "wilted" appearance, in the opinion of the author, was more the effect of an internal disturbance than of an external ecological one. In the company of Mr. Andrew Simon, of Towson, Maryland, the author revisited the Peach Bottom locality on August 11, and several more colonies of this form were observed.

This form may appropriately be named:

DRYOPTERIS HEXAGONOPTERA forma **furcata** Reed, forma nov.

Pinnae 2–3 cm. infra apices furcatae, divisionibus saepe imbricatis.

Type in Reed Herbarium, Baltimore, Maryland, collected along ravines, just east of Peach Bottom, Lancas-

[1] Reed, Amer. Fern Journ. 35: 104–105. 1945.

ter County, Pennsylvania, August 4, 1946, by Clyde F. Reed (No. 5514). There are several specimens in the Reed Herbarium.

BALTIMORE, MARYLAND.

New Species and Combinations in Woodsia, Section Perrinia

T. M. C. TAYLOR

The writer became actively interested in the genus *Woodsia* some ten years ago, when a number of puzzling specimens were collected in the course of botanical exploration of the north shore of Lake Superior. A detailed study of the genus as represented in North and South America was interrupted by the outbreak of the war, and it is only recently that it has been possible for him to pick up some of the threads of previous botanical work.

The writer's sincere thanks are due to the curators of practically all the important herbaria in America, as well as those of the Royal Botanic Gardens, Kew, and the British Museum (Natural History), for their generosity in placing specimens at his disposal for study. His apologies, however, are also due these same officials for unpublished new names and combinations that have been on annotation slips for several years without validation. In view of the fact that circumstances still do not permit completion of the detailed treatment, it seems expedient to publish some nomenclatural notes at this time.

The following artificial key indicates some of the chief characters found to be useful in separating the North American species.

Indusial segments terminating in conspicuously elongate, articulate, flattened hair-tips.

Lower surface of pinnae bearing articulate hairs and platelike scales ..... *W. confusa.*
Lower surface lacking such hairs and scales ..... *W. pusilla.*
Indusial segments not terminating in conspicuously elongate hair-tips.
Indusial segments more or less filiform from the first, inconspicuous.
Lower surface of pinnae bearing flat, articulate hairs. *W. scopulina.*
Lower surface of pinnae destitute of hairs ..... *W. oregana.*
Indusial segments conspicuously broader, wedge-shaped.
Lower surface of pinnae bearing articulate hairs. *W. appalachiana.*
Lower surface of pinnae lacking articulate hairs ..... *W. obtusa.*

WOODSIA OREGANA D. C. Eaton f. **oregana** (D. C. Eaton) Taylor, comb. nov.

Woodsia oregana D. C. Eaton, Canad. Nat. II. **2**: 90. 1865.

The type was collected at "Dalles of the Columbia River, Oregon," by Major Raines, U. S. A., in 1855. I have seen a specimen of the type collection in the Kew Herbarium, originating from the Eaton Herbarium. Eaton based his description upon this form, characterized by the absence of glands even in the young stages, which thus becomes the nomenclatural type of the species. It does not follow, however, that the nomenclatural type need represent the biologic type, and in the present case, inasmuch as both the eglandular and glandular forms occur together, it might be misleading to designate the former as "*typica.*" Because this subdivision includes the type of the specific epithet, it is permissible under Art. 56, Sect. XXXV, of the "International Rules of Nomenclature," ed. 3 (1935), to designate this form by the same epithet unaltered, viz. *oregana.*

WOODSIA OREGANA f. **glandulosa** Taylor, f. nov.

Rachibus et laminis subtus plus minusve glandulosis.

This form is characterized by varying degrees of glandularity on the rachis and lower side of the pinnae. The type, in the Toronto Herbarium, was collected on Batchawana Bay (47° N, 84° 45′ W), Algoma District, Ontario, by Taylor, Hosie, et al. (No. 246), August 2, 1935. An isotype is in the National Herbarium of Canada.

Although apparently most common in the Lake Superior Basin, this form occurs also throughout the range of the species.

WOODSIA PUSILLA Fourn. var. **glandulosa** (Eaton & Faxon) Taylor, comb. nov.

Woodsia pusilla Fourn. Bull. Soc. Bot. France **27**: 329. 1880.

Woodsia Plummerae Lemmon, Bot. Gaz. **7**: 6. 1882.

Woodsia obtusa var. *glandulosa* Eaton & Faxon, Bull. Torr. Bot. Club **9**: 50. 1882.

The type was collected in Mexico "in montibus San Miguelito," in September, 1877, by Schaffner (No. 68).

WOODSIA PUSILLA var. **Cathcartiana** (Robinson) Taylor, comb. nov.

Woodsia Cathcartiana Robinson, Rhodora **10**: 30. 1908.

The type, in the Gray Herbarium, was collected at Taylor's Fall of the St. Croix River, Minnesota, by Miss Ellen Cathcart in 1874.

WOODSIA PUSILLA var. **mexicana** (Fée) Taylor, comb. nov.

Woodsia mexicana Fée, Mém. Foug. **7**: 66. 1875; non R. Brown, nota in Wallich, Pl. As. Rar. **1**: 41. 1830.

The type was collected near San Angel, Mexico, by W. Schaffner (No. 306) in 1855.

The following key may aid in the recognition of the varieties of *Woodsia pusilla*.

Pinnae and rachis essentially eglandular, if somewhat glandular, then with the pinnae remote, narrowly lance-attenuate to an acute or subacute apex, the pinnules remote (in dried specimens), denticulate, the teeth sometimes prolonged into gland-tipped hairs; indusial segments 4 or 5, broad at base, approaching those of *W. obtusa* ..... var. *mexicana*.

Pinnae and rachis obviously glandular.

Blades elliptic-lanceolate, often glaucescent, pinnate-pinnatifid or rarely bipinnate; pinnae approximate, lance-ovate to broadly lanceolate, oblong to oblong-elliptic, denticulate, ciliate, the hairs gland-tipped; indusia as in var. *mexicana*. var. *glandulosa*.

Blades somewhat narrowly lanceolate, dark green, bipinnatifid; pinnae oblong, denticulate, separated by rather wide sinuses; indusial segments usually narrow, approaching those of *W. oregana* ..... var. *Cathcartiana*.

WOODSIA **confusa** Taylor, sp. nov.

Habitu W. *scopulinae* similis; stipitibus laminam aequantibus vel excedentibus, nitidis, sursum stramineis, deorsum rubro-brunneis, basi paleis dissitis stramineis, angustis, longe attenuatis in apice piliformi instructis; paleis rhizomatis plus minusve anguste ovato-lanceolatis, saepe concoloribus; laminis 2–3 dm. longis, pinnato-pinnatifidis, ambitu lineari-lanceolatis; pinnis plus minusve remotis, suboppositis vel alternis, 1–2 cm. longis, linearilanceolatis, attenuatis, apice subacuto, alte partitis, alis costalibus angustis; pinnulis 2–3 mm. longis, oblongis, crenulatis, margine revolutis, apice rotundatis, supra fere glabris, subtus plus minusve glandulosis, pilis paucis articulatis et paleis dissitis, planis, albidis vel pallide brunneis, lineari-lanceolatis, multicellularibus praeditis; soris submarginalibus, saepe non confluentibus; indusiis alte partitis, segmentis numerosis, angustis, apice filiformi, multicellulari.

Similar in habit to *W. scopulina;* rhizome scales tending to become narrowly ovate-lanceolate, all concolorous in general; stipes as long as, or longer than, the blades, lustrous, stramineous above, becoming dark reddish-brown below, toward the base clothed with scattered, stramineous, narrow, long-attenuate scales with hairlike tips; blades 2–3 dm. long, pinnate-pinnatifid, linear-lanceolate in outline; pinnae somewhat remote, subopposite to alternate, 1–2 cm. long, lance-linear, tapering to a subacute apex, deeply cleft, but always with a narrow wing connecting the adjacent pinnules; pinnules 2–3 mm. long, oblong, the margins shallowly crenate, revolute, rounded at apex, the upper surface essentially glabrous, the lower more or less glandular, sparsely clothed with flattish, articulate hairs and usually with a few scattered, flat, white or pale brown, linear-lanceolate, multicellular scales; sori submarginal, not as a rule becoming confluent; indusium deeply cleft into numerous, narrow segments terminating in long filiform, multicellular hairs.

The type, in the Toronto Herbarium, was collected in crevices in greywacke on east side of Thunder Cape, Thunder Bay District, Ontario, July 31, 1936, by Taylor,

Losee, and Bannan (No. 2159). An isotype is in the National Herbarium of Canada. This species occurs in the Lake Superior region in Minnesota and Ontario.

WOODSIA **appalachiana** Taylor, sp. nov.

Habitu *W. scopulinae* similis, indusiis plus minusve cupuliformibus crasse laceratis vel interdum in segmentis paucis latis ad $\frac{2}{3}$ partitis, paleis basi stipitis anguste lanceolato-attenuatis, apice longo, piliformi, medio linea fusco-brunnea vel fere nigra instructis differt.

Similar in habit and form to *W. scopulina*, but differing in the indusium remaining somewhat cupshaped with coarsely lacerate margin, or sometimes splitting about two-thirds into a few broad segments, and in the stipe scales being narrowly lance-attenuate with long fine hair-tips, and with a dark-brown, or even black, longitudinal band simulating a midrib.

The type, in the Gray Herbarium, was collected on a mountain 4 miles north of Old Sweet, West Virginia, September 14, 1903, by Mr. and Mrs. E. S. Steele (No. 306). This species occurs in the Southern Appalachian and Ozark Mountains.

UNIVERSITY OF BRITISH COLUMBIA, VANCOUVER, B. C.

Glandular Prothallia of Notholaena Standleyi

ALICE F. TRYON

A series of plantings were made of fern spores taken from dried Arizona specimens received from Dr. W. S. Phillips. Spores of *Notholaena Standleyi* Maxon germinated in about 15 days and glands bearing a secretion were observed on the margins of the prothallia (Fig. 1). The glands were visible to the naked eye and are similar to those produced on the under surface of the frond.

The first indication of the gland is a protrusion from a marginal cell of the prothallium (Fig. 2). This moundlike protrusion elongates and cytokinesis occurs

transversely to the longitudinal axis, giving rise to two cells, viz. a stalk cell and a head cell (Fig. 3). The head cell becomes spherical and when fully mature is covered by a waxy, light yellow secretion (Fig. 4). Excluding the secretion, the width of the head cell is 23–35 micra. The secretion on old closely placed glands tends to become

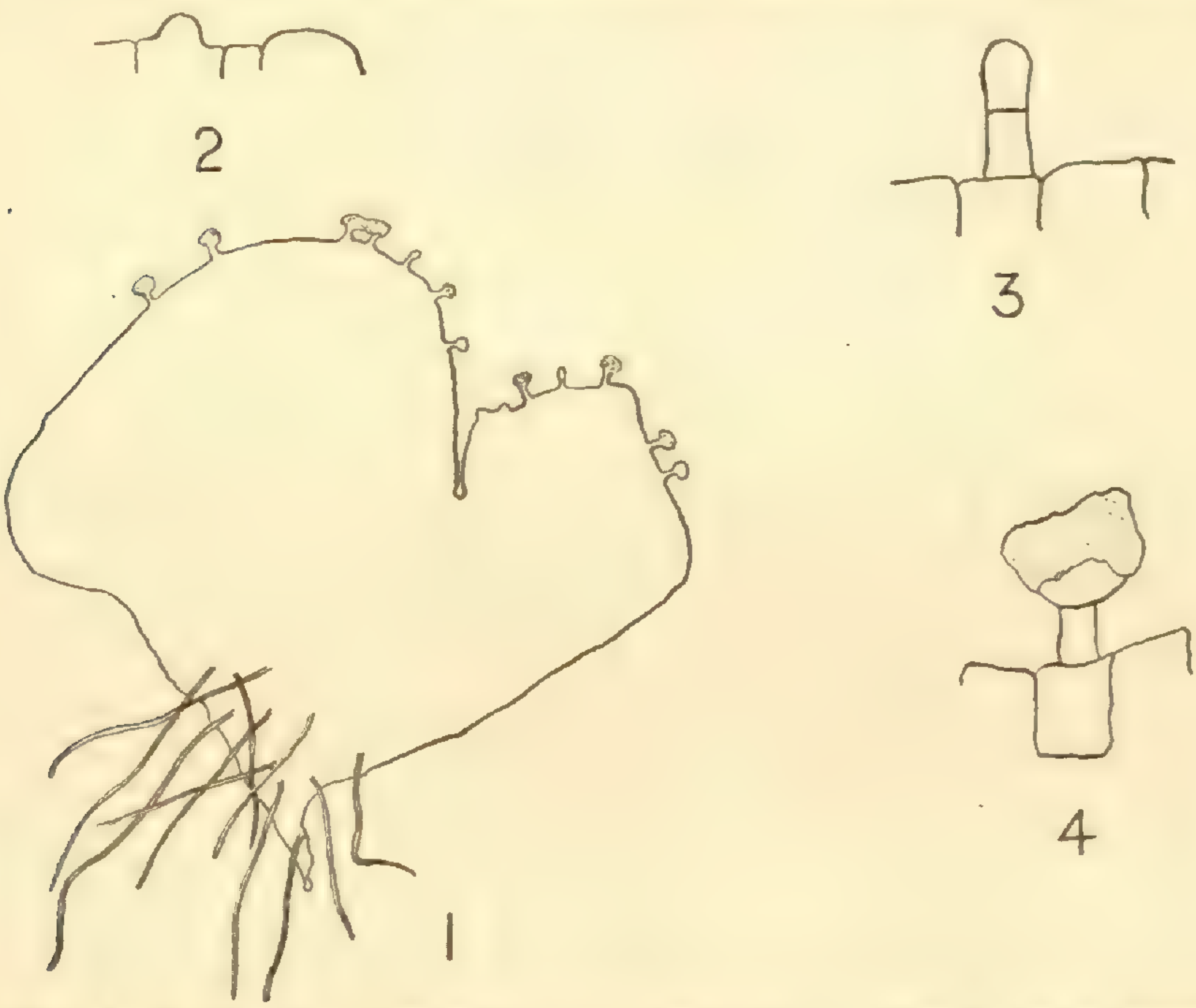

Fig. 1, Prothallium of *Notholaena Standleyi*, ×25; 2, very young gland, ×140; 3, immature gland, ×140; 4, mature gland, ×140.

contiguous. The length of the gland averages 66–70 micra.

F. O. Bower[1] has previously reported glands on the prothallia of *Notholaena trichomanoides* (L.) Desv.

These are two examples of the gametophytic inheritance of sporophytic indument. This is of special interest, because prothallia usually have no such characters of the sporophytic plant.

DEPARTMENT OF BOTANY, UNIVERSITY OF MINNESOTA.

[1] The Ferns, 1: 198. *fig. 186.* 1923.

Tree-climbing Gleichenias

WARREN HERBERT WAGNER, JR.

The small family Gleicheniaceae was formerly thought to include two genera only, *Gleichenia* and *Stromatopteris*. However, present-day students are inclined to separate several additional genera, such as *Dicranopteris*, *Sticherus*, and *Hicriopteris*. Little has been written on the life histories and growth habits of these ferns. Copeland[1] says "*Gleichenia* thrives under insolation more intense than most ferns endure, and various species form dense thickets in open places, the dense tangle of stiff hard stipes and rachises making them almost impenetrable." Safford[2] described these ferns in Guam as "growing in the sabanas, or upland, grassy regions. . . . In places where the sabanas have been burned over the stiff, erect stipes project a few inches above the surface, and often cause wounds in the feet of the natives, even when the latter are protected by leather sandals." Christensen[3] noted that in Madagascar they were "very common in destroyed woods." Thus, Gleichenias have usually been regarded as "sun-ferns," and this is most often the case.

The first time I observed *Sticherus* was in the grassy dry hills near Caguas, Puerto Rico. Here *S. bifidus* occurs in patches along road banks and in open fields in colonies somewhat similar to those of the bracken. The plants were at most several feet high. In Guam *Dicranopteris linearis* has exactly the same habit. In the Hawaiian Islands this fern is exceedingly abundant in both fields and woods, and is very conspicuous as a suc-

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[1] Bernice P. Bishop Mus. Bull. 59: 31. 1929.
[2] Contr. U. S. Nat. Herb. 9: 283. 1905.
[3] Dansk. Bot. Ark. 7: 174. 1932.

cession plant in all the higher altitude zones. In Oahu Hosaka[4] has illustrated the spread of *D. linearis* over a quadrat in Kipapa Gulch. He writes that this plant is the "greatest undergrowth competitor in the Ohia Zone, and the ground vegetation of ferns may be crowded out slowly" by it. I was fortunate enough to be a member of a botanical party under the leadership of Dr. Harold St. John on a trip through Kipapa Gulch, and I had an excellent chance to observe this plant in its densest growth. The tangles here are so dense in some places that if one can break through at all it is a strenuous struggle.

However, if a botanist in the tropics has hard and fast concepts of the habitats of the species he finds, he is sooner or later in for some great surprises as he travels from place to place. Thus in Guam *Lindsaea ensifolia* is a fern of the dry open rocky fields, yet the first time I found this fern on Manus in the Admiralty Islands it was growing in the mud in the center of a deep sago-palm swamp! As a further example, *Asplenium falcatum* occurs in Guam terrestrially on and around limestone cliffs and boulders, so dependably that its habitat alone can be used to separate it from the epiphytic *A. pellucidum*. In the Admiralties, however, *A. falcatum* is normally an epiphyte.

The Admiralty Islands yielded a surprise in its Gleichenias also. The first specimen of *Dicranopteris linearis* that my colleague, Lt. D. F. Grether, and I discovered during our study of the ferns of the Admiralty Islands was a lone plant growing in the mud of a stream bank on Los Negros Island. We next found small plants on banks near the Lorengau River Falls in Manus. However, later we paddled up the Lorengau River to the Falls and found great masses of this plant growing on the damp

[4] Occasional Papers Bernice P. Bishop Mus. 13: 17, 209–210. 1937.

Dicranopteris linearis Climbing High in Trees, Manus Island

forested slopes, and some of the masses were climbing at least 150 feet up to the tops of tall trees! *Sticherus laevigatus* grew with it, climbing high also, its luxuriant fronds sometimes tangled with those of the other species.

In writing of Gleichenias in Hawaii, MacCaughey[5] said that "In the forests, and along wooded ridges, the *uluhi* (*Dicranopteris linearis*) often assumes a climbing habit. The petioles and rachides become greatly elongate, so that a single leaf may attain the length of 20 or more feet. The leaves clamber up over bushes and into the trees but rarely rise over a height of 15 ft."

Holttum[6] wrote, "A *Gleichenia* thicket may persist for a considerable time, but in the ordinary course of events it is gradually invaded by trees and shrubs; some of the hardiest of these may have become established at the same time as the fern, but develop more slowly. The young trees in time produce a low secondary forest, in which the *Gleichenia* persists (often associated with *Nepenthes*) in a less vigorous condition, its fronds often growing much longer than in the open, and climbing some distance up the trees." The luxuriant climbing habit which we observed along the Lorengau River is apparently the ultimate of the late succession described by Holttum. The woods here must be very old second-growth, and unusually ideal conditions have permitted the Gleichenias to continue growing. Examination of an aerial photograph of the lower Lorengau River shows numerous open spots and an unevenness of the forest, suggesting that these forests may have been cleared or fired. Growth of the *Sticherus* and *Dicranopteris* here is by no means "less vigorous." In the same place *Selaginella Hieronymiana* climbs up to 50 feet or more on the trunks of trees. Dr.

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[5] Torreya **18:** 3, 49. 1918.

[6] In Verdoorn, Manual of Pteridology 442–445. 1938.

A. H. G. Alston, who kindly identified our specimens, writes that he is "interested to learn that it climbs."

Near the summit of Mount Tjajiak, in south-central Manus, we found three species of Gleicheniaceae growing in an open spot, along with *Lycopodium cernuum*, a species which very often accompanies them. Both the Gleichenias mentioned were here also, but much smaller in stature, and a third, *Sticherus hirtus*, with very tall, long-stipitate fronds, grew in one large patch. The natives use the pectinate pinnae of the last as plumes which they place as decorations in their bushy black hair. It is interesting to note that near this old mountainside clearing there occurred also the climbing pitcher-plant, *Nepenthes*, just as Holttum mentioned. The only other place we found *Dicranopteris* on Manus was in an overgrown coconut grove southeast of Lorengau. It climbed here as it does in the river valley, but only up to about 15 feet.

The fronds of *Dicranopteris* are very well suited to climbing in great masses because of their indeterminate, repeatedly dichotomous growth habit.[7] In the usual small form in dry places the hairy bud between the opposite pinnae atrophies apparently, and the plants remain low in stature. In wet woods under conditions that arise occasionally, as in the Admiralties and to a lesser extent in the Hawaiian Islands, the fronds will continue to divide. In Guam I have never found this type of luxuriant forest growth, although the plants occasionally make dense tangles on the edges of wooded damp ravines which cut through the savannahs. I have never found a place where this plant occurred as part of the climax, although the rich forest of the lower Lorengau River in Manus certainly resembles one.

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[7] A detailed discussion of the branching and anatomy of leaves of Gleicheniaceae is given in M. A. Chrysler, Amer. Journ. Bot. 30: 735–743. 1943, and 31: 483–491. 1944.

Gleichenias apparently do not occur on limestone. In the "haystack" limestone hills near Bayamón and San Juan, Puerto Rico, Gleichenias were not seen, although numerous cleared and burned-over areas existed there, and the absence of these plants from limestone areas was noted also in Guam, Hawaii, and the Admiralties—in all these places the plants occurred in volcanic or other non-limestone areas. In the completely calcareous areas near Guiuan, in Samar, and on Biak, off the coast of New Guinea, no Gleichenias were seen at all.

UNIVERSITY OF CALIFORNIA.

Recent Fern Literature

Charles E. De Vol: Ferns and Fern Allies of East Central China. Shanghai. Musée Heude: Notes de Botanique Chinoise, No. 7, pp. 1–154. April, 1945.

The area covered has not quite 200 reported native pteridophytes. It is one of extensive, intensely cultivated plains, contributing less than 30 species, and numerous mountain ranges, with a maximum altitude approaching 2,000 meters. One of these many ranges is Lushan, 1,000 to 1,700 meters high, with the resort community Kuling, where Ching was Keeper of a botanic garden, and where De Vol collected 140 species. Thus more than 70 per cent of the ferns known in East Central China are found in one vicinity.

The interpretation of genera follows Ching, as is both seemly and wise. The largest genera are *Dryopteris* (in a restricted sense), 16 species; *Asplenium*, 15; *Selaginella*, 13; *Athyrium*, 12; *Diplazium*, 10; *Thelypteris*, 9. *Cyclosorus*, which outnumbers *Dryopteris* 70 to 7 in the Philippines, has here only 3 species. Emphatically, this is a temperate, not a tropical, flora. This fact needs to be understood, before the richness of the Chinese fern

flora, as compared with that of North America and Europe, can be appreciated.

In the keys, indexing, and records of collections and of range, this Flora compares favorably with others of the same kind.—E. B. COPELAND.

American Fern Society

A recent editorial query elicits the information that "Index to North American Ferns," by Maurice Broun, is still available from the author, whose present address is: Route 2, Kempton, Pennsylvania. To members of the Fern Society the price is $2.00. This little book, published in 1938, has proved exceedingly useful.

Would any members be interested in growing ferns from spores, sterile culture method? Only women wishing to continue working here after the training period should contact us. They should have bacteriological as well as botanical background, preferably with microscopic and slide-making experience. A real opportunity for two people in a small laboratory.—MISS CLARA S. HIRES, *Mistaire Laboratories, 152 Glen Ave., Millburn, New Jersey.*

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Published by the

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EDITORS

WILLIAM R. MAXON

R. C. BENEDICT C. V. MORTON

IRA L. WIGGINS

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American Fern Journal

VOL. 37 OCTOBER–DECEMBER, 1947 NO. 4

Dryopteris hexagonoptera in Quebec[1]

MARCEL RAYMOND AND JAMES KUCYNIAK

Discovery of a new station for *Dryopteris hexagonoptera* (Michx.) C. Chr. at St. Grégoire (Mt. Johnson), in Iberville County, affords the authors an opportunity to define the known distribution of this species in Quebec. According to Broun,[2] the present range extends from eastern Texas to the northernmost portion of Florida, north to Minnesota and Quebec. To date, reports of its occurrence in the last-mentioned locality have given rise to a number of erroneous statements. Most collectors have confused it with the neighboring species *D. Phegopteris* (L.) C. Chr. Both, to be sure, have in common non-ternate, triangular fronds which set them apart from the other northeastern American species of the genus. Nevertheless, *D. hexagonoptera* has a facies distinctly its own. It has much larger fronds. The lower pinnae vary from 25 mm. to 70 mm. in breadth and the rachis is winged to the lowermost pair. The wings of the pinnae trace a more or less geometrical figure almost perfectly hexagonal, a character from which the fern derives its name.

Past experience with published references to collections of *Dryopteris hexagonoptera* reported from this district has led the authors to eliminate rather than accept the citations at face value. When they have had the opportunity to obtain for examination specimens cited as this

[1] Paper read on October 8, 1945, at the 13th annual meeting of the Association Canadienne-Française pour l'Avancement des Sciences, held in Montreal.

[2] Index to North American Ferns, 134–135. 1938.

[Volume 37, No. 3, of the JOURNAL, pp. 65–96, was issued September 29, 1947.]

species, the material invariably turned out to be *D. Phegopteris* in one or another of its many phases.

John Macoun and T. J. W. Burgess[3] in their "IX.—Canadian Filicinae" list a number of different Quebec stations where this rare species has been collected. Not a single specimen, however, was found in the set representing the entire lot of Quebec collections of *D. Phegopteris* and *D. hexagonoptera* at present housed in the National Herbarium (Canada) which Dr. A. E. Porsild kindly lent the authors recently for study. Macoun's[4] observation on the relation between *D. hexagonoptera* and *D. Phegopteris,* to the effect that they are sometimes difficult to separate one from another, apparently indicates that he was hardly familiar with the species which E. T. Wherry[5] appropriately terms the "Southern Beech-fern."

In his "Filicinées du Québec," F. Marie-Victorin[6] cites collections from the following localities: Hatley (Stanstead Co.), *H. Mousley;* Quebec, *Hon. Wm. Sheppard;* Waterloo (Shefford Co.) and Sorel (Richelieu Co.), *Lady Dalhousie;* Nuns' Island (Archipelago of Montreal), *S. H. Parsons.* With the Mousley Herbarium of Quebec Orchids and Ferns now deposited in the Institut Botanique of the Université de Montréal, the authors were able to examine the aforementioned collector's specimen as well as an identical duplicate from the National Herbarium. Both are *D. Phegopteris.* One might do well to question the authenticity of the determinations of those credited to Lady Dalhousie, though it would be unfair to take into consideration only her purely amateur status in the field of systematic botany. The authors, likewise, have not been able to retrace the material reportedly collected by Parsons or Sheppard.

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[3] Trans. & Proc. Roy. Soc. Canada 2 (sect. IV): 198. 1884.
[4] Catalogue of Canadian Plants 5: 269–270. 1890.
[5] This JOURNAL 26: 129. 1936.
[6] Contrib. Lab. Bot. Univ. Montréal 2: 55–56. 1923.

Owing to the limited number of certified specimens of *D. hexagonoptera* in local herbaria, little as yet is known of the limits of its distribution in Quebec. Those revised —and the number may hardly be held conclusive—tend to mark the species, in this particular region of eastern Canada, as a floristic element of the Monteregian hills. The hills which according to J. A. Dresser and T. C. Denis[7] number eight in all, include among others Mt. Royal, Mt. St. Bruno and Mt. Johnson. Composed of igneous rock, each rises abruptly from 600 to over 1,000 feet above the flat lowlands of the St. Lawrence valley. All are located within 50 miles of Mt. Royal, itself in the heart of the city of Montreal.

The first authentic mention of *Dryopteris hexagonoptera* in Quebec should legitimately be credited to Mme. Claire Morin-Gauthier, who originally collected it (*Claire Morin* 246) at Mt. St. Bruno on August 28, 1934. A decade later, in the immediate environs of Mt. Johnson, the authors found it in two different types of habitats. Their first collection (*Raymond & Kucyniak* 44–806) dates from August 6, 1944, when they discovered a large colony growing in moist soil in the maple grove at the foot of the volcano-shaped hill. The second station (*Raymond & Kucyniak* 45–823) was located on August 23, 1945, on one of the rocky slopes wooded with sugar maple. All specimens are in the Marie-Victorin Herbarium of the Institut Botanique.

The station at Mt. St. Bruno and the two stands at Mt. Johnson are the only Quebec localities known with certainty for this fern, one of the less familiar in our flora.

The authors wish to thank Drs. E. T. Wherry and A. E. Porsild for pertinent services rendered.

MONTREAL BOTANICAL GARDEN.

[7] Geology of Quebec 2: 455. 1944.

The Ferns of Wayne County, Pennsylvania

W. L. DIX

Wayne County is the northeastern county of Pennsylvania. Its northern boundary is along the 42d parallel, which separates the states of New York and Pennsylvania. The west branch of the Delaware River which meets the east branch at Hancock, New York, flowing in a south-easterly direction, forms the eastern boundary for approximately 25 miles to a point near Narrowsburg. From here Wayne is separated from Pike County by a line S 31° 45′ W to the Wallenpaupack Creek, which there becomes the county line to the northern boundary of Monroe County. From here it follows this boundary line westerly to the upper reaches of the Lehigh River. Then in a northeasterly direction this river is the line for about five miles, and then the county line runs N two degrees W back to the New York State line.

The county is about 50 miles in length and 20 miles wide at its widest part. It contains 720 square miles. Although there are some 40 villages in the county, the population is distinctly rural.

Nearly the entire county is drained by the Delaware River. The divide between that river and the Susquehanna enters the county on the western border near the northern boundary. For a few miles it extends in a southeasterly direction to Lake Shehawken, where it is nearly halfway across the county. From this point it extends about seven miles southwesterly to Sugar Loaf Mountain, near the western boundary of the county. Then for a course of about 25 miles it follows the summit of the Moosic Range, close to and paralleling the western boundary of the county to a few miles below Waymart, where the Moosic leaves the county as the western boundary of the Lackawanna valley. The area west of

this divide belongs to the Susquehanna watershed and is drained almost entirely by the Starrucca Creek and its tributaries.

The Delaware watershed in Wayne County is drained largely by the Lackawaxen Creek. Its principal tributaries are the Dyberry toward the north, and in the south the Wallenpaupack. The extreme northeastern part of the county is drained by Shrawder's and Shehawken creeks, running northeasterly into the Delaware. A few miles below these and out of the Lackawaxen watershed are the Equinunk and Calkin's flowing into the Delaware in a slightly north of eastern direction. The extreme southwestern tip of the county is drained by the Lehigh River.

The elevation of the county above sea level is from 1,000 feet along the lower streams to 2,200 feet, and along the western border of the Moosic Range, Mt. Ararat, and Sugar Loaf to 2,600 feet. This elevation serves to give the northern part of the county a New England climate, with occasional frosts during the summer months and winter temperatures down to 30 degrees below zero.

A special feature of the county is its 65 to 70 small lakes. Nearly half of these are in Preston Township, an area of about eight miles square. Many of them have no inlets and are fed by under-water springs. Throughout the county are also many bogs and swamps that quite evidently were formerly lakes. Some of these have recently been covered with sphagnum, forming the so-called quaking bogs. They are usually surrounded by a fringe of rhododendrons, tamarack, and spruce.

The bedrock underlying the county is a gray Catskill sandstone. This has a southerly slope of about 20 to 30 feet to the mile except over a small area in the north, where this slope is reversed. On the western boundary near Forest City the rocks are in the syncline of the

Lackawanna Valley for a short distance. Along the Moosic Range and in a small area near Pleasant Mount appears what is known as Pocono sandstone. On the summit of the Moosic is found also a stone known as millstone grit, used by the early settlers for their millstones and for huge pots for melting glass.

There is no limestone area in the county, but scattered over various parts are large boulders known locally as "nigger heads" and geologically as calcareous breccias. Where these are exposed to the weather they have a pock-marked appearance and are almost black. Some of them are of glacial origin, but others appear to overlie the definitely stratified rocks. Occasionally one finds a few quartzite erratics, all of glacial origin.

The soils of Wayne County are composed of glacial till of both local and foreign origin. Most of the county is overlain with what is known as Volusia, made up of clay, silt, and angular fragments of rocks. Along the western border, along Cherry Ridge in Texas Township, and in many small areas throughout the county occur Lackawanna soils. These are a reddish color, and are known locally as "red shell," and are derived from local rocks. Small areas of Chenango soils, composed of sand, silts, and gravel, occur along the Delaware River and Dyberry and Lackawaxen creeks.

The forests of Wayne County are practically all of second growth. White pine (*Pinus Strobus*), for which the county was famous, occurs now mostly as individual trees here and there. Most of the hemlock is also gone except in a few scattered stands in the northern townships. Other forest trees are *Betula lenta, B. lutea, Fagus americana, Acer saccharum, A. rubrum, Quercus alba, Q. rubra, Fraxinus americana, Prunus serotina, Tilia americana, Ulmus fulva,* and *U. americana.* Other scattered trees are hickories, butternuts, and in the

southern part of the county the "poplar" (*Liriodendron tulipifera*). The chestnut, once so common in some parts, is still struggling for survival.

The first published account of the ferns of Wayne County occurs in the report of the Second Geological Survey of Pennsylvania, by I. C. White, Harrisburg, Pa., 1891. He prints a letter from "Professor John M. Dolph, an accomplished botanist of Honesdale," with a list of several hundred plants of Wayne County which he had "personally examined and identified during the last two years." In this list are 13 ferns and five fern allies. A few records of collections from Wayne County also appear in Twining's Flora of Northeastern Pennsylvania.

The first collector of ferns in Wayne County of which any specimens are extant was Dr. Abram P. Garber, who in 1867 and 1869 made collections of various plants from Sterling in the south all the way up to Preston Township in the north. Among other botanists who have visited the county are Bayard Long, Hugh Meredith, Charles Francis Saunders, Alexander MacElwee, Dr. T. C. Porter, Dr. O. E. Jennings, and Dr. Ernest M. Gress. Recently the author has made extensive collections in the northern part of the county, and Dr. Edgar T. Wherry and Stanley Glowenke have collected over the entire county.

A great number of the ferns listed below are common throughout the entire county wherever conditions are suitable. A few are known at present to occur nowhere else in the state. Some also find their southern limits in Wayne County.

The nomenclature here adopted follows no one authority, but it should not be too difficult to know what species is being discussed.

BOTRYCHIUM MULTIFIDUM var. TYPICUM. This grape-fern was first collected in Pennsylvania by the writer

in 1938, in Scott Township. It has since been collected by him and by Dr. Wherry in several localities in the adjoining township of Preston. These were the only collections of var. *typicum* in the state until Dr. Wherry discovered it in the adjoining county of Susquehanna. Without doubt it will be found in suitable localities farther to the south. Rare.

BOTRYCHIUM MULTIFIDUM var. INTERMEDIUM. Recorded from Scott, Preston, and Dreher townships. More common than these few collections indicate.

BOTRYCHIUM DISSECTUM. Common throughout the county.

BOTRYCHIUM OBLIQUUM. Common throughout the county, exceeding the previous species by a ratio of about 3 or 4 to 1.

BOTRYCHIUM OBLIQUUM var. ONEIDENSE. Scott and Preston townships. These two collections should not be taken as indicative of such a restricted distribution. It can probably be found throughout the county.

BOTRYCHIUM LANCEOLATUM var. ANGUSTISEGMENTUM. Most collections are in the northern part of the county, recently, however, in Sterling. It probably occurs in all townships.

BOTRYCHIUM MATRICARIAEFOLIUM. One collection from Sterling, and a good many from Honesdale northwards. It probably is present in all townships.

BOTRYCHIUM SIMPLEX var. TYPICUM. Collected only in South Sterling by Bayard Long in 1906. Probably overlooked in other places.

BOTRYCHIUM SIMPLEX var. TENEBROSUM. The author has a specimen collected in Scott Township in 1938 which represents this variety. There is also one in the Academy of Sciences in Philadelphia collected by Long in 1906. Not common.

BOTRYCHIUM VIRGINIANUM. In all parts of the county in suitable localities.

OPHIOGLOSSUM VULGATUM. Collected in 1906 by Bayard Long in South Sterling, by Hugh Meredith at High Lake in 1921, and by the writer in Preston Township in 1938.

OSMUNDA CINNAMOMEA. Common in swamps throughout the county. The writer has collected the following forms of this species in Preston Township: *incisa, auriculata,* and *bipinnatifida.* Forma *crenulata* described by the writer from Lake Shehawken in 1934 is merely a juvenile condition.

OSMUNDA CLAYTONIANA. Common throughout the county, though not well represented in herbaria.

OSMUNDA REGALIS. Somewhat more restricted than the two last species, but found in swamps and at the edge of lakes throughout the county.

LYGODIUM PALMATUM. The only known locality for this species in the county is in Sterling Township, recently reported by Richard Harlow.

DENNSTAEDTIA PUNCTILOBULA. Everywhere. A great nuisance in pastures.

ADIANTUM PEDATUM. Common in rich soil throughout.

PTERIDIUM LATIUSCULUM. Regarded as a weed throughout the county.

WOODSIA ILVENSIS. Collected in Honesdale in 1920 by Jennings and Gress, by Dr. Wherry four miles west of Newfoundland, and recently by H. Iltis at Eagle Point, on Lake Wallenpaupack. Rare.

WOODSIA OBTUSA. The only reported station is near South Sterling, where it was discovered by Harlow. At this station is a large colony of furcate forms which persist from year to year. Apparently rare.

CYSTOPTERIS FRAGILIS var. GENUINA. Collected by Dr. Wherry in Scott Township in 1939.

CYSTOPTERIS FRAGILIS var. MACKAYI. Collected in many places through the entire county.

CYSTOPTERIS BULBIFERA. The only recorded specimen

is one collected by the writer in Scott Township. Here it grows in dry woods among large boulders. This species is probably to be found in other suitable places in the county.

ONOCLEA SENSIBILIS. In wet soil throughout the county.

ONOCLEA SENSIBILIS var. OBTUSILOBATA. Collected east of Waymart in 1935 by Dr. Wherry, in South Sterling in 1921 by Dr. Walter Mendelson, and by Hugh Iltis at Frisbee's Pond in 1936.

PTERETIS NODULOSA. The Ostrich Fern was collected at Newfoundland by C. O. Reidel in 1882. Dr. Saunders got it near Sugar Loaf in 1900, and the writer collected specimens at Island Pond in 1942. It is more common than collections indicate.

ATHYRIUM PYCNOCARPON. Collected by Bayard Long in South Sterling in 1906 and by the writer in Preston Township in 1937. Apparently rather rare in the county.

ATHYRIUM THELYPTEROIDES. The Gladefern, as Dr. Wherry calls it, is not at all common. Collections are from Scott, Salem, Lake, and Sterling townships.

ATHYRIUM ANGUSTUM var. TYPICUM. This variety has been collected by Arthur Leeds at Honesdale, and by Dr. Wherry in Scott and Dreher townships.

ATHYRIUM ANGUSTUM var. RUBELLUM. Collected at many localities from Honesdale northward.

ATHYRIUM ANGUSTUM var. ELATIUS. This variety was collected by Gress and Jennings at Honesdale in 1920, and by Dr. Wherry at Jericho in the lower part of the county in 1942.

ASPLENIUM TRICHOMANES. The Maidenhair Spleenwort grows in rock crevices throughout the county.

ASPLENIUM PLATYNEURON. The Brownstem Spleenwort probably occurs throughout the county, but for

some reason does not find suitable soil for its growth in the northern part and it is not at all common there. In the southern part it becomes more common.

ASPLENIUM EBENOIDES. This hybrid between *Asplenium platyneuron* and *Camptosorus rhizophyllus* has been collected by Richard Harlow near South Sterling.

CAMPTOSORUS RHIZOPHYLLUS. Collections of the Walking Fern are by Dr. Meredith in Preston Township in 1921, by the writer recently in Scott and Preston, by Gress and Jennings at Waymart in 1920, and at White Mills by J. W. Adams. It probably occurs in all townships.

LORINSERIA AREOLATA. This Chain-fern has been collected in the county only by Mendelson, at South Sterling, in 1916.

WOODWARDIA VIRGINICA. Collected by Dr. Wherry near Aldenville in 1941, and Gress reports a collection from a near by locality. This species is among the ferns reported from the county by Dolph. Rare.

POLYSTICHUM BRAUNII. Braun's Holly-fern was first discovered by the writer in Wayne County at Lake Shehawken in 1935, and later in Scott Township in 1938. Then about 1940 Richard Harlow found a locality near South Sterling, where it grew abundantly over a rather extensive area. Mr. Harlow has also discovered there a hybrid between this fern and *P. acrostichoides*.

POLYSTICHUM ACROSTICHOIDES. One of the commonest ferns in the county. The varieties *incisum* and *crispum* have been collected by the writer in Preston Township.

DRYOPTERIS INTERMEDIA. The commonest of the Wood-ferns and found throughout the county. A cross between this fern and *D. marginalis* was found by Dr. Wherry near Gouldsboro in 1940.

DRYOPTERIS SPINULOSA. In moist ground, at the edge of swamps, and on hummocks in bogs and swamps

throughout the county. The variety *fructuosa* has been collected in Preston Township and Sterling.

DRYOPTERIS CAMPYLOPTERA. This northern fern was found on Mt. Ararat by the writer in 1940. It was reported from Sugar Loaf Mountain in the Flora of Northeastern Pennsylvania, but can not now be found there. This Ararat locality is now the only station for its occurrence in Pennsylvania. There is a great variation in the forms of this species at this locality. Dr. Wherry has separated two crosses from the material collected by the writer: *D. campyloptera* × *intermedia* and *D. campyloptera* × *spinulosa*.

DRYOPTERIS MARGINALIS. Common throughout the county, but much less so in the northern townships.

DRYOPTERIS GOLDIANA. Not at all common. It has been collected in South Sterling, and in Preston and Scott townships.

DRYOPTERIS CLINTONIANA var. GENUINA. All the collections of this species in the county have been in Scott and Preston townships by the writer and Dr. Wherry. *Dryopteris Clintoniana* × *intermedia* has been collected by the writer in Scott Township in 1941. Apparently rare.

DRYOPTERIS CRISTATA. Probably to be found in swamps and bogs throughout the county. More common than the two last species. "*A. cristatum* f. *marginale* Dav." is reported from Orson by Clute in the Fern Collector's Guide, and in the Flora of Northeastern Pennsylvania.

DRYOPTERIS BOOTTII. Boott's Fern has been collected only in Oregon, Lake, and Preston townships, but is common in the swamps in the northern part of the county.

THELYPTERIS PALUSTRIS. Only two collections of the Marsh Fern have been made in the county, but it is common in moist ground throughout.

THELYPTERIS SIMULATA. The Massachusetts Fern or,

as Dr. Wherry calls it, the Bogfern, was found independently by the writer and by Dr. Wherry in two separate localities in 1940 near Orson, in Preston Township. Rare.

THELYPTERIS NOVEBORACENSIS. Grows throughout the county.

PHEGOPTERIS POLYPODIOIDES. Common throughout the county.

PHEGOPTERIS HEXAGONOPTERA. The only collections of the Broad Beech-fern in Wayne County are by the writer at Lake Shehawken. Probably overlooked elsewhere.

PHEGOPTERIS DRYOPTERIS. Found in cool, rocky, shaded woods throughout the county.

POLYPODIUM VIRGINIANUM. Common throughout, on cliff-tops, rocks, and rarely on tree-trunks.

LYCOPODIUM LUCIDULUM. Very common throughout.

LYCOPODIUM CLAVATUM. Common everywhere in woods and fields.

LYCOPODIUM CLAVATUM var. MEGASTACHYUM. Found at South Sterling by G. R. Proctor in 1945.

LYCOPODIUM COMPLANATUM var. TYPICUM. Collected by Jennings and Gress near Honesdale in 1920. Very rare in Pennsylvania.

LYCOPODIUM COMPLANATUM var. FLABELLIFORME. Common throughout.

LYCOPODIUM OBSCURUM. Both var. *genuinum* and var. *dendroideum* are pretty well distributed over the county.

LYCOPODIUM ANNOTINUM. This species is not so common as the last, but can probably be found in all townships.

LYCOPODIUM TRISTACHYUM. Not at all common, but collected from Scott, Preston, Lake, Paupack, and Sterling townships. Twining's Flora reports it from Buckingham Township.

LYCOPODIUM SABINAEFOLIUM. This northern species

has recently been collected by Richard Harlow and identified by Dr. Wherry from a locality near South Sterling, the only record for Pennsylvania. It is rather difficult to explain the presence of this species and the Hollyfern, two boreal species, in the southern part of the county.

LYCOPODIUM INUNDATUM. This small clubmoss was collected near Lehigh Pond in 1937, and by the writer at the other end of the county at Lake Shehawken in 1939. Rather rare.

EQUISETUM ARVENSE. A weed everywhere.

EQUISETUM FLUVIATILE. In the following lakes: Hiawatha, Shehawken, Spruce, Beech, Ariel. Known also from the shore of the Delaware River about 3 miles southeast of Ball's Eddy.

EQUISETUM HYEMALE. Collected at South Sterling by MacElwee in 1921. Mentioned in Dolph's list of Wayne County flora. Apparently rare.

EQUISETUM SYLVATICUM. Rather generally distributed throughout the county.

ISOËTES BRAUNII. From the following lakes, all in Scott and Preston Townships: Star Pond, Hiawatha, Island Pond, Little Hickory, Poyntelle, and Bone Pond.

ISOËTES ENGELMANNII. In the Delaware River about 3 miles southeast of Ball's Eddy, and in a creek near Niagara, Mt. Pleasant Township.

ISOËTES DODGEI (*I. riparia* var. *canadensis*). From the following lakes: Shehawken, Starlight, Como, Coxton, Poyntelle, and Bigelow, all in the northern part of the county.

SELAGINELLA RUPESTRIS. Collected by Iltis in 1942 near Uswick, in Paupack Township. Mentioned in Dolph's Flora as collected by him in Wayne County. Rare.

MORRISVILLE, PENNSYLVANIA.

A Pellaea of Baja California

CARLOTTA C. HALL

While studying the western North American species of the genus *Pellaea* in the herbarium of the University of California, three sheets of a well-marked and apparently new *Pellaea*, closely related to *Pellaea ternifolia* (Cav.) Link, were noted from the "Cape Region" of Baja California. The first collection was made by T. S. Brandegee in the Sierra de la Laguna in January, 1890; the second, in the "Cape Region" by Mr. Brandegee in 1893; the third, in the Laguna Mountains by Marcus E. Jones (no. 24556), in March 1928. It is here proposed to name this new species *Pellaea Brandegeei*, in honor of Townshend Stith Brandegee, its first collector. The collection labeled "Cape Region, Lower California, 1893" (University of California Herbarium No. 122,735) is selected as the type. However, all three collections are drawn upon in the following description:

Pellaea Brandegeei C. C. Hall, sp. nov. *P. ternifoliae* affinis, frondibus fere ad apicem bipinnatis, pinnis pedicellatis, pinnulis longius mucronatis differt.

The distinctive character of *P. Brandegeei* is its petiolulate trifoliolate pinnae. The petiolules are black, 2 to 4 mm. long, and bear the three pinnules at the tip. The pinnules are mostly straight, flat, obtuse or truncate, long-mucronate, the lateral ones up to 2 cm. long, the middle one up to 3 cm. long and 5 mm. wide. The blade is 20 to 28 cm. long and 4 to 6 cm. wide. The rootstock is short and compact; its reddish brown scales have toothed margins and very long-attenuate spiral or tortuous tips, and are with or without a dark median line.

Examination of 75 well-developed fronds of *P. ternifolia* did not disclose any frond with petiolulate pinnae. The pinnae have revolute margins and are mostly falcate.

TYPE SPECIMEN OF PELLAEA BRANDEGEEI (AT LEFT)

Moreover, the fronds on the whole were smaller in size, the blades ranging from 7 to 18 cm. long and 1 to 4 cm. wide.

Because of its descriptive name, a cotype of *P. ternifolia* var. *petiolulata* C. Chr. from Bolivia was borrowed from the U. S. National Herbarium and compared with *P. Brandegeei.* There are two fronds on the sheet. One is bifurcate in the upper half and several pinnules are divided also. The three pinnules of the pinnae are not borne together at the tip of the petiolule, but there is a pair at its base close to the primary rachis and the third is at its tip. The pinnules are short, revolute, and strongly falcate. The variety *petiolulata* has the aspect of an abnormal plant.

Cassebeera ternifolia var. *stipitata* Farwell[1] was also considered because of its suggestive name. It is based on a specimen of *P. mucronata* with slightly stipitate pinnules. It does not at all belong to the *P. ternifolia* group and has properly been transferred to *P. mucronata* by Maurice Broun.[2]

Pellaea Brandegeei has an isolated and restricted geographic range in the Cape Region, which is the mountainous tip of the long narrow peninsula of Baja California. The Cape Region is about 80 miles long and 30 miles wide and lies mostly south of 24° N. Latitude, which places it within the tropics. The Laguna Mountains are in its northwestern part. They receive much of the rainfall that comes to that region. In 1893 Mr. and Mrs. Brandegee visited the Cape Region in September and October after the summer rains, disembarking at San José del Cabo. Owing to lack of rain there, little collecting was done in that vicinity, and their collections of that year were made "in the western part of the mountains of the Cape Region," which is the region of the Sierra de la Laguna.

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[1] Amer. Midl. Nat. **12:** 282. 1931.
[2] Index to North American Ferns, p. 132.

This is the most definite information given as to the type locality of *P. Brandegeei.* An account of the collections of this trip was published by Mr. Brandegee in his private publication, Zoe.[3] No mention is made of this *Pellaea,* but he says, "there yet remain a considerable number of species, requiring careful study, which for lack of time could not be made ready for this paper." For some years following, Mr. Brandegee botanized in Mexico proper and apparently never returned to a study of the residue of his Cape Region collections. He never gave a name to the type specimen of *P. Brandegeei,* but indicated its relationship by mounting it on a sheet with a frond of *Pellaea ternifolia* from the Hawaiian Islands.

BERKELEY, CALIFORNIA.

Some Notes on Hawaiian Asplenieae

C. V. MORTON

The Hawaiian representatives of the genera *Asplenium, Athyrium, Diplazium,* and *Sadleria* have long been recognized as a difficult and complex group. Characters which ordinarily distinguish species in *Asplenium* apparently do not hold in the Hawaiian representatives. It seems that either there are a great many species occurring in the islands or only very few, highly polymorphic ones. The latter appears to be true, for although individual specimens of diverse form may look utterly unlike, abundant material often shows them to be connected by a maze of intermediate forms.

The basis of most modern work on the Hawaiian species is Hillebrand's treatment in his *Flora of the Hawaiian Islands* (1888). He recognized 30 species and 30 varieties of true *Asplenium.* Miss Winifred Robinson's treatment[1] added little to our knowledge of the genus, and

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[3] **4**: 398–408. 1894.

[1] Bull. Torrey Club **40**: 206–220. 1913.

Christensen's account in his "Revised List of Hawaiian Pteridophyta" (1925) followed conventional lines. The most important contribution to our detailed knowledge of the species is to be found in Dr. C. Skottsberg's recent study "Vascular Plants from the Hawaiian Islands III: Pteridophytes collected during the Hawaiian Bog Survey 1938."[2] His studies, based largely on the structure of the scales and spores, have cleared up some of the most difficult problems, particularly in the group containing *Asplenium contiguum*, *A. caudatum*, *A. falcatum*, and *A. horridum*. Unfortunately, he did not treat all the Hawaiian species. The following notes are supplementary to his treatment, and are based largely on an examination of the types of Brackenridge's species, which are in the U. S. National Herbarium.

Asplenium fragile Presl, Tent. Pterid. 108. 1836.

This species, based on a collection by Haenke from Peru (photograph of type, US), was first attributed to the Hawaiian Islands by Hooker[3] on the basis of collections by Diell and Douglas. *Asplenium rhomboideum* Brack.,[4] described from Baños, Peru (U. S. Expl. Exped., type US), is reduced to a variety (unnamed), following Mettenius.[5] This treatment was followed until Miss Robinson[6] treated the Hawaiian plant as a distinct endemic species, unfortunately adopting the name *A. rhomboideum* Brack., which, as stated above, actually came from Peru. The U. S. Exploring Expedition did collect this species in the Hawaiian Islands, but Brackenridge did not associate the specimens with his *A. rhomboideum*, apparently including them with his *A. Menziesii* [i.e., *A. monanthes*], probably as juvenile forms. In the most

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[2] Medd. Göteborgs Bot. Trädgard **15**: 35–148. 1942.
[3] Sp. Fil. **3**: 145. 1860.
[4] U. S. Expl. Exped. **16**: 156. 1856.
[5] Abh. Senck. Naturf. Ges. **3**: 169. 1860.
[6] Bull. Torrey Club **40**: 209. 1913.

recent enumeration of Hawaiian ferns, Christensen[7] follows Miss Robinson in considering *A. rhomboideum* an endemic Hawaiian species.

Mr. Weatherby in his treatment of *Asplenium fragile* and its allies[8] pointed out this error in the following words: "Dr. Winifred Robinson makes the surprising statement that the type locality of *A. rhomboideum* Brack. is the Hawaiian Islands. It is, of course, actually from Baños, Peru, and no other collection is cited by Brackenridge. The identity of his plant is quite clear from his excellent figure and the Wilkes Expedition specimen in the National Herbarium. The Hawaiian plant in question (which is closely related to, but hardly conspecific with, the Andean) he seems to have referred to *A. Menziesii* Hook."

This leaves the proper name for the Hawaiian plant undecided, no distinctive name having ever been proposed. However, I have compared the material at hand closely with the abundant Andean specimens now available, and I am unable to find any difference in scales or spores, or any constant differences in general habit and shape of pinnae which would justify recognition as a species. By combination of the following characters, however, the Hawaiian form may conveniently be regarded as an insular variety.

Asplenium fragile Presl var. **insulare** Morton, var. nov.

A var. typica rhachibus validis, laminis magnis 15–35 cm. longis, pinnis fere omnibus basi superiori auriculatis differt.

Differs from the typical variety in being larger and coarser, with thicker rhachises and larger fronds (15–35

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[7] Revised List of Hawaiian Pteridophyta, Bishop Mus. Bull. 25: 13. 1925.

[8] The group of Asplenium fragile in South America, Contr. Gray Herb. 95: 52. 1931.

cm. long), and in having almost all the pinnae with a basal superior auricle.

Type in the U. S. National Herbarium, no. 815,565, collected in the Hawaiian Islands by D. D. Baldwin (no. 34).

This is one of the few Hawaiian ferns of Andean relationship. I have seen the following additional specimens: Mauna Kea, *Topping* 3625. Mauna Kea (or perhaps Mauna Loa),[9] U. S. Expl. Exped. Hillebrand reports this species only from Haleakala, Maui.

Asplenium insiticum Brack. U. S. Expl. Exped. **16**: 161. *pl. 22, f. 1.* 1854.[10]

Brackenridge's original material was a mixture of two species. The specimen actually illustrated must be taken as type, and this is in the National Herborium mounted on sheet no. 50,453. That Hillebrand was undecided as to the identity of the species is shown by the note on *A. spathulinum* on page XCVI of his *Flora of the Hawaiian Islands.* Unfortunately, he chose the wrong element as type, and his identification has been followed ever since. His species 24, called *A. spathulinum* Hook., is the true *A. insiticum* Brack. The name *A. spathulinum* J. Smith ex Hook. is a *nomen abortivum,* since *A. insiticum* is cited in synonymy. Species no. 17, which Hillebrand calls *A. insititium,* has apparently never received a distinctive name.

However, I do not believe that Hillebrand's species 17 may be distinguished from *A. lobulatum* Mett. (species 16). It is more divided than the typical form of that

[9] There are two labels on this sheet, one reading "In forests, return from Mauna Kea," the other "Found in a cave, 8000 ft., Mauna Loa." There are two species represented on the sheet, *A. monanthes* L. and *A. fragile* var. *insulare* (juvenile), and it is not certain which species goes with which label.

[10] Misspelled originally *insiticium* (which later authors have sometimes modified to *insititium*) in the text, but spelled correctly *insiticum* on the plate.

species, but all intermediates occur. As I recognize it, *A. lobulatum* includes plants from simply pinnate (*A. pseudofalcatum* Hillebr.) to bipinnate. Plants which are bipinnate-pinnatifid or tripinnate (*A. sphenotomum* var. *connectens* and *A. sphenotomum* Hillebr., respectively) should probably be included also, but I keep them distinct provisionally. This group is distinguished by pale stipes, leathery (or sometimes rather thin) texture, gemmiferous rhachises, and distant sori. The true *A. insiticum*, with dark stipes, rigid texture, no gemmae, and contiguous sori, belongs to a different group of species, and is very closely related to *A. rhipidoneuron* W. J. Robinson, the Hawaiian representative of the widespread *A. praemorsum* Swartz, small forms being distinguishable from that species only with difficulty.

Asplenium Macraei Hook. & Grev. Icon. Fil. **2**: *pl. 217*. 1831.

Mr. Alston[11] has called attention to the species *Darea pectinata* J. E. Smith (in Rees Cycl. **11**: Darea No. 6. 1808), which was based on a collection of Menzies made in the Hawaiian Islands in 1803. This species has been overlooked by subsequent authors and is omitted in Christensen's Index Filicum. Alston does not identify the species, but states that it is a dareoid form of some species of *Asplenium*. Smith's description shows that *D. pectinata* must be a form of *Asplenium Macraei*, a species much later in date. Recently I forwarded a pinna of typical *A. Macraei* (Ekahanui, Oahu, T.H., *Degener* 11970) to Mr. Alston for comparison with the type of Smith's species, and he has stated that he believes the two to be conspecific although they are not identical—which is not surprising, considering that *A. Macraei* is so variable that hardly any two specimens are exactly alike. Fortunately, the specific epithet *pectinata* may not now

[11] Phil. Journ. Sci. **50**: 177. 1933.

be transferred to *Asplenium* to replace *A. Macraei*, because of *Asplenium pectinatum* Wall. ex Mett. Abh. Senck. Naturf. Ges. **3**: 241. 1860.

Asplenium schizophyllum C. Chr. Ind. Fil. 131. 1905.

Asplenium dissectum Brack. U. S. Expl. Exped. **16**: 170. 1854, not Swartz (1788).

Asplenium dissectum var. *kauaiense* Hillebr. Fl. Hawaii 606. 1888.

Asplenium nephelephyllum Copel. Phil. Journ. Sci. Bot. **9**: 440. 1914.

Copeland's specimens of *A. nephelephyllum* (*Faurie* 266 from Waimea, Kauai) match the type of *A. dissectum* Brack. [i.e., *A. schizophyllum*] very well. His concept of *A. schizophyllum*, as evidenced by specimens so named in his herbarium, evidently is based on plants which I would refer to *A. sphenotomum*, and those which he calls *A. sphenotomum* I would call *A. sphenotomum* var. *connectens*, i.e. plants merely bipinnate-pinnatifid rather than tripinnate. The true *A. dissectum* is quadripinnate, with monosorous ultimate segments and dareoid sori. It is known only from Kauai and is evidently of very restricted distribution.

SMITHSONIAN INSTITUTION.

A Fern New to Baja California

IRA L. WIGGINS

Mr. C. F. Harbison spent several weeks collecting in central Baja California, Mexico, in March and April, 1947. The plant material was deposited in the herbarium of the San Diego Society of Natural History. Mrs. Ethel B. Higgins, Curator of the Herbarium, kindly forwarded a number of the specimens to me for identification or verification, or to give me an opportunity to study selected

material in connection with the preparation of a "Flora of the Sonoran Desert."

It is a pleasure to report that Mr. Harbison obtained a number of specimens from the vicinity of San Francisquito Bay and Barril that represent striking extensions of range for several desert plants. Among them is a collection of *Notholaena Standleyi* Maxon, collected on "top of grade between Barril and Calmallí, Baja California," April 5, 1947. This species had been known previously from Oklahoma, Texas, New Mexico, Arizona, Coahuila, and Sonora. I had collected it in Arizona and in the Sierra Picú and near Caborca, northwestern Sonora. Hence, Mr. Harbison's collection extends the known range over 100 miles, and is the first record for the peninsula of Baja California.[1]

The range of *Notholaena Standleyi* as disclosed by this extension fits the pattern of distribution shown by a number of other plants that have apparently used Tiburon and Guardian Angel Islands as a "bridge" across the Gulf of California. There is evidence to support the view that this migration route has permitted a number of plants with their main centers of distribution in Baja California to cross into Sonora. *Notholaena Standleyi,* among others, has used the same route but in the opposite direction.

The material on the sheet which Mrs. Higgins permitted me to keep in exchange for making the determination consists of several pieces of rhizome well clothed with the characteristic glossy scales with dark mid-sections and lighter margins. There are about 15 fronds in various stages of development. Some bear mature sporangia; others are still too young to display soral lines around the margins of the segments.

STANFORD UNIVERSITY.

[1] See Amer. Fern Journ. 34: 48(1944) for map showing position of Barril. Sierra Picú lies about 20 miles east-northeast of Libertad, Sonora.

A Crispate Variant of the Christmas Fern

EDGAR T. WHERRY

Some years ago the late Albert F. W. Vick, founder of Vick's Wild Gardens, showed me in the woods of the property east of Glenmoore, Pennsylvania, where he raised native plants for the trade, a large colony of an unusually attractive Christmas Fern. The margins of the pinnae are jaggedly cut, with the teeth tending to widen upward and curl so as partly to overlap. This presumably corresponds to what was named by Clute in 1901 *Polystichum acrostichoides* var. *crispum* (mistakenly cited as forma *crispum* in Broun's Index), a *nomen subnudum*, in that the only diagnosis given was that "the pinnules are beautifully crisped and ruffled."

Since no illustration of this variant seems to have been published, a sketch by Mr. Joseph M. Devlin is here reproduced. This shows how the pinnae are gradually reduced upward, without any sori being produced. Similar types of cutting accompany lack of fertility in certain other species, as *Asplenium platyneuron* var. or f. *Hortonae*, *Polypodium virginianum* f. *cambricoides*, and some Boston Ferns.

UNIVERSITY OF PENNSYLVANIA.

Shorter Note

GLANDULAR CYSTOPTERIS FRAGILIS IN THE ROCKY MOUNTAINS.—Throughout its nearly world-wide range, *Cystopteris fragilis* is generally a glabrous species. No form of it is known to produce true hairs. In var. *laurentiana* Weath. of eastern North America and var. *sempervirens* Moore of Spain and the Atlantic Islands the indusia and sometimes the costae are sparsely glandular, but in all forms, with the single exception noted below, the leaf-tissue is glabrous.

It was therefore a surprise and a matter of interest when Mr. F. W. Hunnewell brought me a sheet containing nine detached fronds collected by him among rocks at Lake Minnewaska near Banff, Alberta, on July 3, 1915 (his no. 3442), all of which are more or less densely beset on the rachis, on both surfaces of the blade (especially the lower), and on the indusia with short, whitish, subcylindric glands. Search in the Gray Herbarium revealed one other collection of this glandular form—a single frond with part of the rhizome attached, taken by Miss Edith Scamman, along with material of ordinary *C. fragilis*, at Angel Glacier, Mt. Edith Cavell, Jasper National Park, Aug. 15, 1943 (no. 3174), about 180 miles north of the Banff station. In addition to the whitish glands, the fronds bear, especially along the rachis and costae, small narrow scales, which are frequently reduced to pluricellular trichomes and are often tipped by a reddish gland. These, however, occur sparingly in other forms of *C. fragilis* and are not of taxonomic significance.

One glandular variety of *C. fragilis* has been described —var. *Huteri* (Hausm. ex Milde) Luerssen.[1] This is a very rare plant, known only from a few localities in the

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[1] Farnpflanzen in Rabenhorst, Kryptogamen-Fl. Deutschland . . . ed. 2, 3: 459. 1889. *C. fragilis*, forma *Huteri* Hausm. ex Milde, Fil. Eur. 149. 1867.

Dolomite Alps and from a single station on Mt. Cenis in the southwestern Alps. I have seen no specimens of it; but the description does not altogether fit the Rocky Mountain material. The indusium is said to be glabrous and the glands more numerous near the margin. Neither statement is correct for the American plant. Nor is a range comprising the eastern and western Alps and the Canadian Rockies, with no intermediate stations, a likely geographic phenomenon. Nevertheless, the Rocky Mountain plant is too close to the European and the evidence at hand too scanty to justify any attempt to segregate it.

The present note is published to call attention to an interesting and seemingly rare variant and in the hope that it may bring in material and information sufficient to determine the taxonomic status of the plant concerned.—C. A. WEATHERBY, *Gray Herbarium.*

Recent Fern Literature

Jesse M. Shaver has continued his fine series of studies of Tennessee ferns. In "Some Notes on Tennessee Cliff-brakes, Chainferns, and the American Hartstongue"[1] he discusses *Pellaea atropurpurea, P. glabella, Woodwardia virginica, Lorinseria,* and *Phyllitis Scolopendrium.* In "Tennessee Spleenworts"[2] eight species of *Asplenium* are treated. And in "The Walking Spleenwort, the Walking-fern, the Narrowleaf Spleenwort, and the Silvery Spleenwort"[3] Professor Shaver takes up the species of *Asplenosorus, Camptosorus,* and *Athyrium.* All the species are carefully described and beautifully illustrated by drawings and photographs, and their distribution within the state is indicated by maps. Of especial interest are the extensive discussions of variations.—C.V.M.

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[1] Journ. Tenn. Acad. Sci. 20: 174–202. 1945.
[2] *Op. cit.* 243–260, 326–362.
[3] *Op. cit.* 21: 143–177. 1946.

Professor Martens[1] of the University of Louvain has made a curious discovery. The sori of the east-American Polypody, *Polypodium virginianum*, and of specimens from eastern Asia referred to that species regularly produce among the sporangia certain secretory organs quite unlike the usual types of paraphyses in ferns and, so far as Prof. Martens knows, unique. They consist of a cluster of inflated, bladder-like cells borne on a several-celled stalk similar to that of a sporangium, but longer. Several of the cells in the cluster give rise to bicellular glandular hairs. The cells secrete tannin, the hairs a resin. These strange organs are epidermal outgrowths like sporangia and indistinguishable from them in the earlier stages of development. Prof. Martens regards them as metamorphosed sporangia. He can see no function for them except as they afford some protection to the true sporangia.

They apparently have taxonomic significance. Prof. Martens, investigating this angle, finds that, of the characters adduced by Prof. Fernald in separating *P. virginianum* from *P. vulgare* of the Old World, those of the scales and venation do not hold. The position of the sorus does; and the presence of the curious little organs he has discovered adds a definite "new distinctive character . . . certainly more reliable than those hitherto employed and preventing any confusion with *P. vulgare.*"

Prof. Martens also finds that the phase of *P. vulgare* in North Africa, the Atlantic Islands, and probably all of the Mediterranean region often, but not always and not abundantly, produces quite a different type of branched paraphyses. True *P. vulgare* of northern Europe has none of any kind.—C. A. WEATHERBY, *Gray Herbarium.*

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[1] Martens, P. Les organes glanduleux de Polypodium virginianum. I. Bull. Jard. Bot. Bruxelles **17**: 1–13, 2 figs. 1943. II. Martens & Nelly Pirard, La Cellule, **49**: 385–406, 3 pls. 1943.

American Fern Society

The annual meeting of the Society will be held at 9 a. m., Saturday, December 27, in the Stevens Hotel, Chicago. Dr. R. M. Tryon, Jr., is Chairman of the Program Committee. It is to be hoped that as many members as possible will be present.

Willard N. Clute, 5257 Hinesley Ave., Indianapolis 8, Ind., has on hand a few publications which he will distribute gratis to members requesting them and forwarding five cents for postage. These are: Dodge, "Fern Allies of New England" (5 copies), "Some Common Plant Families" (3 copies), "Papers presented at the Boston Meeting of the Linnaean Fern Chapter, 1899 (5 copies), "Fern Bulletin," Vol. 1, No. 1 (one copy), Vol. 4, No. 4 (15 copies). Only one booklet will be sent to a member.

NEW MEMBERS

Mr. A. M. Coury, P. O. Box 703, Greenville, South Carolina.
Mr. Oscar O. Eckstein, 2646 No. Williams Ave., Portland 12, Ore.
Mrs. Montella Freeland, Route 1, Box 114, Central Point, Oregon.
Mr. Bartley G. Furey, 278 Bayview Ave., Freeport, New York.
Mr. Joseph C. Knotek, 2021 Superior St., Racine, Wisconsin.
Dr. D. M. Milne, Room 805, Bank Commerce Building, Portland 3, Maine.
Dr. De Witt Stetten, White Bridge Farm, Rushland, Bucks Co., Pa.

CHANGES OF ADDRESS

Mr. William H. Baker, Inst. of Marine Biology, Charleston, Oregon.
Mrs. Kathleen S. Boyd, 7107 Clinton St., Cleveland, Ohio.
Prof. Douglas W. Dunlop, University of Wisconsin, 623 West State St., Milwaukee 3, Wisconsin.
Mr. T. T. Earle, Dinwiddie Hall, Tulane University, New Orleans 15, Louisiana.
Mr. William F. Rapp, Jr., Gaylord Hall, Doane College, Crete, Nebraska.
Mr. Robert Stuart MacKerricher, 2647 Channing Way, Berkeley, California.
Dr. Henry K. Svenson, American Museum of Natural History, Central Park West at 79th St., New York 24, N. Y.

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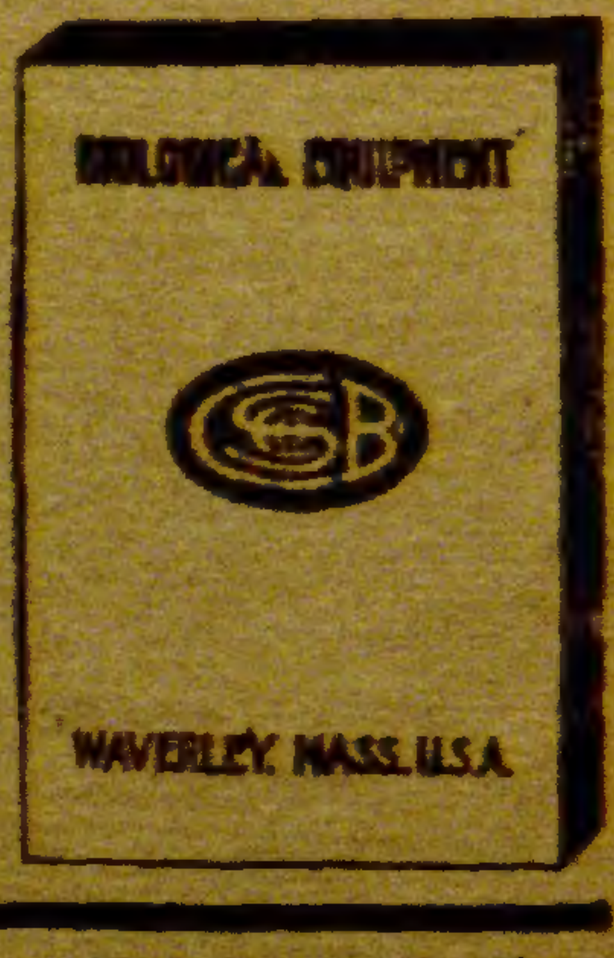

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